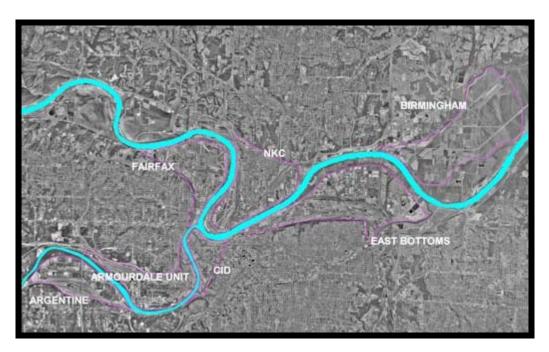
Draft Environmental Impact Statement

Kansas Citys, Missouri and Kansas Flood Damage Reduction Study Missouri and Kansas Rivers





U. S. Army Corps of Engineers Kansas City District 601 E. 12th St. Kansas City, Missouri 64106-2896

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1 DRAFT 2 **Environmental Impact Statement** 3 4 Kansas Citys, Missouri and Kansas 5 Flood Damage Reduction Study 6 Missouri and Kansas Rivers 7 8 The responsible lead agency is the Kansas City District, Corps of Engineers. The USEPA, Region 9 VII, is a participating coordinating agency as addressed in CEQ regulations 40CFR1501.6. 10 11 **Abstract**: The Corps, at the request and with the cooperation of the five distinct non-Federal 12 sponsors of the seven levee units in the Kansas City metropolitan area, has undertaken this study of 13 the Kansas Citys, Missouri and Kansas, Flood Damage Reduction Study, Missouri and Kansas 14 Rivers. This existing levee system protects areas in the Cities of Kansas City, North Kansas City and 15 Birmingham, Jackson and Clay Counties, Missouri, and in the City of Kansas City, Wyandotte 16 County, Kansas. The Corps is undertaking this study under the authority of Section 216 of the 1970 17 Flood Control Act. 18 19 The purpose of this study is to determine whether one or more plans for improving the level of flood 20 damage reduction is technically viable, economically feasible, and environmentally acceptable, or if 21 no action is warranted. Failure of any part of the existing flood damage reduction system during a 22 major flood would have significant adverse impacts on the human environment, including property 23 damage and potential loss of human life. Considering these potential significant impacts on the 24 human environment, and in accordance with the National Environmental Policy Act, the Corps 25 initiated preparation of a Draft Interim Feasibility Report and Draft Environmental Impact Statement 26 (DIFR/DEIS). This DIFR and DEIS presents an analysis of several alternatives considered during 27 scoping and a detailed analysis to determine what action, or if any action, is warranted to minimize 28 the potential for loss of human life and property damage related to failure of the levee system in the 29 event of a major flood. Proposed alternatives identified to improve flood damage reduction 30 reliability include: levee raise with pump station modifications or replacement to include floodwalls, 31 stoplog gaps, top caps, and rock toe; pressure relief wells; floodwall modification using buttresses; 32 new sheetpile wall; buried collector system; and the no action alternative. This DIFR/DEIS identifies 33 a combination of the alternatives listed above as the Corps' preferred alternatives of the 34 Recommended Plan, and presents a detailed study of the environmental impacts associated with each 35 of the alternatives listed above. Comments will be accepted until 17 July 2006. 36 37 If you would like further information on this DEIS please contact: 38 Dr. Christopher M. White 39 Kansas City District, Corps of Engineers 40 601 E. 12th Street Kansas City, Missouri 64106-2896 41

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DEPARTMENT OF THE ARMY

KANSAS CITY DISTRICT, CORPS OF ENGINEERS 700 FEDERAL BUILDING KANSAS CITY, MISSOURI 64106-2896

Executive Summary

The seven levee units addressed for this study include: the North Kansas City, Northeast Industrial District (East Bottoms) and Birmingham units in Missouri and the Argentine, Armourdale, and Fairfax-Jersey Creek Units in Kansas. The Central Industrial District (CID) levee unit, which protects land in both Kansas and Missouri, is also addressed. These units collectively comprise the protective works that provide flood protection for areas in Kansas City, North Kansas City and Birmingham, Jackson and Clay Counties, Missouri and in Kansas City, and Wyandotte County, Kansas.

This study results from interest by the local levee districts and Kansas City, Missouri for the examination of improvements to the existing line of protection which might benefit residents, business owners, landowners, and persons employed within the levee protected areas consistent with National Civil Works policy.

The existing levee system including underseepage control structures protects approximately \$16 billion dollars of investment within the protected areas consisting of:

- Over 5.000 individual structures
- The employment of 90,000 individuals
- The Charles B. Wheeler Downtown Airport
- Several vital utilities
- Extensive rail and road systems within the protected areas that are of regional and National importance.

Although no overtopping occurred within the Kansas City area during the Flood of 1993, water crested near the top of the levees and floodwalls in some of the levee units. Water pressure during flood events may stress structural components, scour the levee toe, or cause the seepage of river water through the levee onto adjacent properties. Some landowners within the levee protected areas experienced intense flood fighting and observed sand boils and sink holes on their property during the 1993 Flood, indicating excessive water pressures and the seepage of river water through the levee foundation. Following the Flood of 1993, the U.S. Army Corps of Engineers (Corps/USACE), Kansas City District (KCD), received correspondence from Kansas City, Missouri expressing concern regarding the reliability of the existing flood damage reduction system.

In accordance with Engineering Pamphlet 1165-2-1 and under the authority of the Flood Control Act of 1970, the Corps has moved forward with the reevaluation of the Kansas City

levees. The feasibility study is being conducted using a 'phased approach'. The phased approach was preferred due to:

- The large magnitude of the overall study area, and numerous features under study.
- The need to seek timely authorization for critical system modifications; some of the most critical sites are being worked under Phase 1.
- The need to keep economic analysis information timely and up-to-date. This could become problematic if feasibility were attempted under a single large report to be issued sometime in the future.
- Funding: Moving forward with Phase 1 authorization efforts now will minimize the schedule impacts of the reduced Federal funding stream.
- Phasing of the various sites will allow those sponsors responsible for multiple units to spread their cost-share funding requirements (for PED and Construction) over several years rather than seeing one large bill for multiple units.

The Argentine, East Bottoms, Fairfax-Jersey Creek, Birmingham and North Kansas City units comprise the Phase I levee units and will be addressed in a draft interim feasibility report (DIFR). The Armourdale and Central Industrial District levee units are examined under Phase II and will be addressed in the final feasibility report.

Engineering, economic and environmental analyses were conducted for the North Kansas City, East Bottoms, Birmingham, Argentine, and Fairfax-Jersey Creek levee units. The results of these analyses and recommendations to increase levee unit reliability are included in the Draft Interim Feasibility Report (DIFR) and this Draft Environmental Impact Statement (DEIS). Analyses of the Birmingham unit found no geotechnical or structural deficiencies. Therefore, no reliability improvements are proposed for this unit.

Preliminary engineering, economic, and environmental analyses have been completed for the CID and Armourdale units. Findings for overtopping risk and geotechnical/structural risk indicate the need to pursue reliability improvements for the Armourdale and CID levee units. Such improvements may involve earthen levee raises, floodwall raises, and underseepage improvements. Tentative preferred alternatives are recommended for these units within this DEIS. The final preferred alternatives recommended for these units are pending the completion of Phase II engineering, economic, and environmental studies, and will be presented in the Final (Phase II) Feasibility Report (FFR).

No overriding areas of controversy were noted during the scoping process. The majority of comments addressed the desire to use the Kansas City levees as recreational trails. The Corps does not own the levees. The levee units addressed in this study are owned and maintained by their respective levee districts. The Kansas City District provides technical assistance to the levee districts and supports dialogue between levee unit sponsors and trail proponents. However, the majority of the land adjacent to the existing levees is heavily industrialized. The levee districts and the Corps are concerned with maintaining a high degree of levee integrity and public safety, and any plans for trails must be compatible with levee integrity.

The Corps' Notice of Intent to prepare an EIS was published in the Federal Register on January 10, 2001. The Corps scoping process was conducted during the summer/fall of 2003 and included meetings with local, state and Federal agencies, organizations and the general public. On August 20, 2003, the Corps held a public information/scoping meeting at North Kansas City, Missouri to present information on the study and to receive input from the public on resources in the affected area, alternatives and potential impacts. Comments were solicited from the public at this initial meeting and accepted through a comment period, which closed on September 22, 2003.

In accordance with the National Environmental Policy Act (NEPA), KCD has prepared a Draft Interim Feasibility Report and Draft Environmental Impact Statement for the Kansas Citys, Missouri and Kansas, Flood Damage Reduction Study, Missouri and Kansas Rivers. The U.S. Environmental Protection Agency (USEPA), Region VII, is a designated cooperating agency for this study and provided hazardous, toxic, and radioactive waste (HTRW) data and mapping, air quality information, and an Environmental Justice evaluation in accordance with Executive Order 12898.

This study considers the impacts of proposed alternatives to determine if increasing the current level of flood protection is technically viable, economically feasible, and environmentally acceptable, or if no action is warranted. The Recommended Plan is the combination of the National Economic Development (NED) alternatives for each of the levee units. The preferred alternatives for the Kansas River levee units (Argentine, Armourdale, and the Central Industrial District) include a levee raise to the nominal 500+3-feet along with improvements to pump stations, floodwalls and underseepage control. The preferred alternatives for the Armourdale and Central Industrial District are tentative as they will be fully evaluated under Phase II in the Final Feasibility Study. The preferred alternatives for the Missouri River levee units (Fairfax-Jersey Creek, North Kansas City, and East Bottoms) primarily address individual components of the existing system that have been identified through analyses to require overtopping and/or underseepage reliability improvements to maintain the integrity of the existing line of protection. The preferred alternatives for these Missouri River levee units include installation of relief wells and a pump station, installation of a buried collector system, strengthening of an existing floodwall and sheetpile wall replacement to improve the reliability of the existing line of protection. The preferred alternatives are components of the overall Recommended Plan.

The impacts from the Recommended Plan range depend on the characteristic of the levee unit considered and the resources within each respective levee unit. Relatively minor adverse impacts to the natural environment and aesthetics are anticipated with overall positive benefits to the socio-economic environment based on an improved level of protection to the local infrastructure. Adverse impacts are limited and are not considered significant because the project is primarily located within the existing footprint of a previously disturbed environment and within a highly industrialized and urbanized area. The Recommended Plan would impact two emergent wetlands measuring approximately 0.007 and 0.02 acres that are located landward of the existing Argentine levee and a 0.17 acre farmed wetland within the proposed borrow area. Although of low quality and diversity, these wetlands do provide limited benefits to wildlife. It is preferable to mitigate resource impacts within the project area.

To increase the protection of the Kansas River units, levee and floodwall construction would result in increasing the height of existing overtopping features an additional 4 to 6 feet in most places potentially impacting river aesthetics in some areas. The proposed raise would further obstruct the view of industry from the Kansas River. No significant riverscape aesthetics are anticipated from the construction of underseepage improvements as these improvements are generally constructed landside and downgradient of the existing levee and are not readily viewed from the Missouri and Kansas Rivers.

Draft Environmental Impact Statement

Kansas Citys, Kansas and Missouri
 Flood Damage Reduction Study
 Missouri and Kansas Rivers

1. Introduction

1.1 Project Location and History

The Kansas Citys project is a unit of the Missouri River basin comprehensive plan authorized by the 1936, 1944, 1946 and 1954 Flood Control Acts that provides local flood protection for the metropolitan areas of Kansas City, Missouri and Kansas City, Kansas. The design of the Kansas Citys project was predicated on the operation of the Kansas River Basin system of flood control lakes. Most of the lakes in that system are in place and operating, but two of the smaller lakes in the system (Grove and Onaga) were determined economically unfeasible and were deauthorized.

The levee units include the Argentine, Armourdale, Birmingham, Central Industrial District (CID), East Bottoms, Fairfax-Jersey Creek, and the North Kansas City unit (Figure 1-1). The protective works primarily consist of levees, floodwalls, bridge and approach alterations, and channel improvements over the lower 9.5 miles of the Kansas River and on the Missouri River from 6.5 miles upstream to 9.5 miles downstream of the mouth of the Kansas River. The 32-square-mile protected area covers the heavily industrialized floodplains of the two rivers. Each of the seven levee units that comprise the flood protection system was designed and constructed in coordination with the other, but each is operationally independent. A modification to raise three of the units (Argentine, Armourdale, and Central Industrial District) was authorized by Public Law 87-874 on October 23, 1962. Complete effectiveness of the overall project is contingent on adequate reservoir control in the upper Missouri and Kansas River basins.

1.2 Levee Unit and Proposed Borrow Area Descriptions

1.2.1 Argentine Levee Unit

The Argentine Unit is located in Wyandotte County, Kansas, on the right bank of the Kansas River between approximate Kansas River miles 10.1 and 4.7 (Figures 1-2 through 1-6). Federal modification and strengthening of works originally constructed by the Kaw Valley Drainage District began in May 1951. Most of the Federal improvements, including repairs of Argentine levee unit damage from the 1951 flood, were completed by 1955. More recent improvements, separately authorized under the 1962 Modification, were completed in 1978 (the 1978 improvements included raising the heights of floodwalls, earthen levees, and associated structures in the Argentine, Armourdale and CID-Kansas levee units). The primary components of the Argentine unit are earthen levee, floodwalls, stoplog and sandbag gaps, pumping plants, and drainage structures. The overall Argentine unit is approximately 5.5 miles long. The floodwalls, in two sections, total 1,338 feet long. Most of the floodwall is about 16 feet tall. The levee embankment consists of compacted earthen material placed in random and impervious zones. Underseepage and stability berms are located in reaches where the height of the levee, foundation strength, and hydraulic gradient require the use of such berms. The levees and floodwalls of the Argentine Unit are currently authorized to pass a maximum Kansas River flow of 390,000 cubic feet per second (cfs) coincident with a Missouri River flow of up to 220,000 cfs.

1.2.2 Armourdale Unit

The Armourdale Unit is located in Wyandotte County Kansas, along the left bank of the Kansas River from mile 7 (Mattoon Creek) to mile 0.3, near the confluence of the Kansas and Missouri Rivers (Figure 1-7). The original levees and floodwalls were constructed under the jurisdiction of the Kaw Valley Drainage District and then modified and expanded in the initial and follow-on Federal projects. The primary components of the unit consist of earthen levee, floodwalls, riprap and toe protection on riverward slopes of levees, toe drains along the concrete floodwalls, sandbag gaps, stoplog gaps, drainage structures, relief wells and pumping plants. The floodwalls are roughly 22 feet high (varies) and are approximately 6,600 feet long. The levees in three sections total about 5.8 miles long with a sandbag gap between the two sections upstream of the floodwall. The uppermost levee section is a tieback from high ground west of Mattoon Creek which then heads downstream to the Union Pacific Railroad tracks. The second section extends from the Union Pacific Railroad embankment near the mouth of Mattoon Creek downstream along the left bank of the Kansas River to the floodwall. The floodwall begins north of the Chicago, Rock Island and Pacific Railroad Bridge and extends downstream to connect with the third levee section. The third levee section ties back into high ground at the embankment of the Lewis and Clark Viaduct. Construction of the Federal project began in 1949 and was completed in 1951. More recent improvements, separately authorized under the 1962 Modification, were completed in 1976. The levees and floodwalls of the Armourdale Unit are currently authorized to pass a maximum Kansas River flow of 390,000 cfs coincident with a Missouri River flow of up to 220,000 cfs.

1.2.3 Central Industrial District Levee Unit

Although the CID Unit is one levee unit, it is operated and managed as two separate and distinct sections: the CID-Kansas section, and the CID-Missouri section.

The CID-Kansas section (CID-KS), is located in Wyandotte County, Kansas, and extends along the right bank of the Kansas River from mile 3.4 to the mouth, then downstream along the right bank of the Missouri River to the Missouri and Kansas State Line (Figure 1-8). The unit consists of levee sections and floodwalls, riprap and levee toe protection and a surfaced levee crown and ramps, a stoplog gap, a sandbag gap, pumping plants, drainage structures, and relief wells. The levee sections total approximately 1.7 miles long. Three sections of floodwall total about 7,900 feet. This section was originally developed by the Kaw Valley Drainage District, and initial Federal improvements entered construction in 1948. Most of the Federal improvements including repairs to levee unit damage from the 1951 Flood were completed by 1955. The most recent improvements authorized under the 1962 Modification were completed in 1979. The CID-KS section is authorized to pass a Kansas River discharge of 390,000 cfs coincident with a Missouri River flow of 220,000 cfs.

The CID-Missouri section (CID-MO) is located in Kansas City, Jackson County, Missouri. The unit extends along the right bank of the Missouri River (river mile 365.7) to the Kansas-Missouri state line (river mile 367.2). The CID-MO section consists of levees, floodwalls, a levee drainage system and pumping plants, sandbag and stoplog gaps, toe and bank protection, and slope protection on the riverward slope. The floodwall totals 1.5 miles long and the levee is about 430 feet long. The initial construction began in 1946. Significant improvements and repair of 1951 Flood damage followed the initial construction and were completed in 1955. The CID-MO section is designed to pass a Missouri River flow of 540,000 cfs.

1.2.4 East Bottoms Unit

The East Bottoms Unit is located in Kansas City, Jackson County, Missouri. The unit extends downstream along the right bank of the Missouri River from river mile 365.6, to the mouth of the Blue River, river mile 357.7, then upstream along the left bank of the Blue River to the Union Pacific Railroad embankment (Figure 1-9). The levee portion is 9.2 miles long. The floodwall portion is 2,190 feet long and either 12 or 14 feet tall. The unit includes drainage structures, stoplog gaps, pumping plants, and relief wells. The initial construction was completed in 1950. The most recent and major Federal work on the East Bottoms Unit was completed in 1974. It is designed to pass a Missouri River flow of 540,000 cfs and a 40,000 cfs Blue River flow along the southeastern Blue River tieback.

1.2.5 Fairfax-Jersey Creek Unit

The Fairfax-Jersey Creek Unit is located on the left bank of the Kansas River (Kansas River mile 0.3) downstream to the mouth of the Kansas River and along the right bank of the Missouri River from Missouri River mile 367.5 to mile 373.9 (Figures 1-10 and 1-11). The flood protection features consist of about 5.3 miles of levees, 4,040 feet of floodwall, riprap and levee toe protection, a sandbag gap, stoplog gaps, drainage structures, relief wells, pumping plants and the Jersey Creek sewer pump station and shutter gate. The main floodwalls average 16 feet tall. The Fairfax Drainage District provides operation and maintenance from levee Sta. 31+50 (boundary line with Kaw Valley Drainage District) to Sta. 313+72 (bluff at upstream end of unit). The initial construction began in 1940. Numerous modifications and improvements were constructed in the late 1940s and early 1950s, the most recent significant Federal work was completed in 1955. Some limited work was completed post 1993 flood under the PL 84-99 program. The levees and floodwalls of the Fairfax-Jersey Creek Unit are designed to pass a Missouri River flow of 460,000 cfs.

1.2.6 North Kansas City Unit

The North Kansas City Unit is operated and managed as two separate and distinct sections: the "Airport section" and the "lower section" (Figures 1-12 and 1-13). Federal construction began in 1946. Several Federal improvements have been made since the initial construction. The most recent Federal work was completed post-1993 flood under the PL 84-99 program in the Airport section. The unit is designed to pass a Missouri River flow of 460,000 cfs upstream of the Kansas River confluence (Upper or Airport section) and 540,000 cfs downstream of the confluence (Lower Section).

- The North Kansas City Unit (Airport Section) is located around the perimeter of the downtown
- airport. The Airport section is owned and maintained by Kansas City, Missouri. The alignment
- passes along the left bank of the Missouri River starting from river mile 369.6 to the downstream
- floodwall at river mile 366.2. The unit is comprised of 2.5 miles of levee, 530 ft of floodwalls,
- and appurtenances including drainage structures, pumping plants, and pressure relief wells. The
- floodwalls range from 7 to 15 feet tall.
- 330 The North Kansas City Unit portions maintained by the North Kansas City Levee District are
- often called the "downstream section" or "lower section" and are located in both North Kansas
- 332 City and in Kansas City, Missouri. These portions include a short upper section extending
- downstream along the left bank of the Missouri River from the bluff just north of the Kansas
- City, Missouri, Waterworks intake to where the Airport section (described above) begins. After
- 335 the Airport section ends, the "downstream section" resumes at the Hannibal Bridge and
- continues in a easterly direction along the left bank of the Missouri River to a point where the
- North Kansas City hillside ditch exits to the Missouri River near the Missouri River Chouteau
- Bridge. At the hillside ditch outlet, a long hillside tieback turns back sharply to the Northwest
- and runs to a termination point just west of the North Cherry Street bridge. The unit consists of

6.2 miles of levee, 310 ft of floodwalls, riprap slope protection, Rock Creek channel relocation, underseepage control measures, pumping plants, drainage structures, and stoplog gaps.

1.2.7 Birmingham Unit

The Birmingham Unit is located in Clay County Missouri on the left bank of the Missouri River, approximately 12.4 miles downstream from the mouth of the Kansas River (Figure 1-14). The major flood protection components include an 11 (eleven) mile levee, 430 feet of floodwalls, riprap slope protection, pumping plants, drainage structures, sandbag gaps, stoplog gaps, underseepage control and stability berms. The Birmingham levee unit is designed to pass a Missouri River flow of 540,000 cfs. The original Birmingham unit was developed by the Birmingham Drainage District. The Federal project in 1952 raised and strengthened the upstream section of the levee. The downstream section was strengthened and modified in 1954 and 1955.

1.2.8 Proposed Borrow Area

Implementing the levee unit preferred alternatives would require using borrow soil from a location close in proximity to the existing levee alignment to minimize haul distance and access existing local haul routes. The use of conventional scrapers, front end loaders, backhoes and haul trucks would be more economical than dredging materials from the Missouri River.

The proposed borrow area measures approximately 276 acres and is owned by Water District Number One (WaterOne) of Johnson County, Kansas (Figure 1-15). The proposed borrow area is located adjacent to the right descending bank between Kansas River miles 11 and 13, Wyandotte County, Kansas. The borrow area is accessed from south 74th Street via Holliday Drive and Interstate 435. Levee access from the proposed borrow area would route from Inland Drive to South 59th Street.

The primary uses of the land are lime storage from the water treatment process and active row-cropping. WaterOne treats water from the Kansas River and occasionally the Missouri River. Because these two water sources are hard waters, one of the treatment processes used by WaterOne is the addition of lime to "soften" the water by removing the carbonate hardness in the water. Lime softening is conducted by adding a form of lime that precipitates out the carbonate hardness. The result of this process is "softened" water and a lime residual (water and calcium carbonate) that must be removed from the treatment process. WaterOne's lime residuals are stored in large lagoons and allowed to dry. After the drying process, which may take a few years, the dried material is excavated and the lagoons are cleared for future use. The excavated material may be transported to a landfill, used as a fill on construction sites, soil amendment on farmland, or other commercial use. Row cropping within the proposed borrow is conducted under a lease agreement. Thus, existing disturbance within the proposed borrow area includes excavating, hauling, grading, and disk harrowing.

1.3 Purpose and Need

The entire system of seven levee units withstood the Flood of 1993. However, some elements of the system were seriously challenged as the flood crested. This flood experience raised a concern that the levees may provide less than the level of protection for which they were designed. Following the Flood of 1993, Kansas City, Missouri, sent letters to the Kansas City District expressing concern regarding the effectiveness of the existing flood damage reduction system. Section 216 of the 1970 Flood Control Act provided continuing authority to examine completed Federal projects to determine whether the projects are providing benefits as intended.

Argentine

Hydrology and hydraulics models, geotechnical and structural analyses, and risk and uncertainty study methods were used to ascertain the existing reliability of the Argentine levee unit and to determine the appropriate engineering measures necessary for overtopping and reliability improvements. Hydrology and hydraulic investigations indicated the need for overtopping reliability improvements. For an existing levee system, such improvements are accomplished through: 1) Raising the levee and/or 2) improving river channel discharge capacity. Geotechnical and structural investigations revealed that levee failure could result from geotechnical and structural sources, as well as failure as a result of overtopping. Therefore, incorporating a levee raise and the technically appropriate engineered solutions for levee stability and underseepage control were determined to accomplish reliability improvements. In addition to the results of engineering studies, factors that affected the alternatives formulation process included economics, the presence of HTRW near the levee, real estate constraints (such as railroad trackage or structures), and the presence of riparian habitat adjacent to the existing levee.

Three levee raise alternatives were identified for the Argentine unit. The alternatives include raising the existing levee to the nominal 500-year+0, nominal 500-year+3, and nominal 500-year+5 level of protection. These raise alternatives include underseepage control features such as buried collectors, relief wells, stability berms, underseepage berms and filter blankets. A typical range of three raises is examined for purposes of allowing economic optimization.

Armourdale

The flood protection of the Armourdale unit primarily consists of earthen levee and floodwall. During the 1993 flood event, water crested near the top of the floodwall and earthen berms at the lower end of the Kansas River (downstream near the Missouri River). Preliminary analyses indicate that risk of overtopping is the primary concern with this unit. A landside levee raise and floodwall modifications or replacements are engineering solutions that would increase overtopping protection. I-walls would be constructed on earthen berms where there is insufficient area for a landside levee raise. Structural evaluations are ongoing.

Central Industrial District

Similar to the Armourdale unit, the flood protection of the CID unit primarily consists of earthen levee and floodwall. The majority of floodwall on the Kansas portion of the CID was constructed on concrete and timber piles. Preliminary pile strength and risk computations showed that these walls may have significant risk under extreme load conditions or have been raised to their maximum level as authorized by the 1962 mod. Under prior projects, the section of floodwall that extends upstream from the Chicago, Rock Island and Pacific Railroad Bridge to the end of the unit near the Seventh Street Bridge was raised and buttressed. The floodwall raises at the time of construction may have been considered the maximum that was possible without replacing the existing floodwalls.

The Missouri portion of the CID unit contains two concrete floodwalls constructed on concrete piles that are separated by the Hannibal Bridge. Preliminary analyses have not found geotechnical or structural deficiencies. Therefore, the preliminary determination is that the modification or replacement of these floodwalls is not required.

East Bottoms

Consultation with local industry within the East Bottoms levee unit protected area revealed that serious flood fighting activity was conducted during the 1993 flood event, particularly between Stations 365+00 and 435+00. Property owners inside of the levee at this location reported multiple sand boils with large areas of excessive seepage. Landside piping (see

glossary) was reported to measure 20 feet in diameter. The 1993 flood did not reach the top of the levee in this area. However, a full head of water pressure to the top of the levee may have lead to catastrophic underseepage failure of this area and all other areas inside the East Bottoms unit. High river stages on the Blue River could most certainly result in full head on the section of the East Bottoms levee that aligns with the Blue River. The Blue River has historically risen as rapidly as 4 feet per hour. High water event observations, underseepage analysis and soils data indicate that reliability improvements in the form of underseepage control would be the required solution for the East Bottoms unit.

Fairfax-Jersey Creek Board of Public Utilities Floodwall

During the 1993 flood event, water crested approximately 3 feet below the top of the BPU floodwall located between stations 287+85 and 302+32. No visible deformations of the floodwall were observed. This floodwall is constructed on a pile foundation. Field tests were conducted to ascertain the reliability of the floodwall. Pile capacity analysis, pile strength analysis and risk computations determined that pile capacity and strength become unacceptable as water elevations meet and exceed elevations of the 1993 event. Therefore, foundation modifications or floodwall replacement/modification would be required to achieve an acceptable pile capacity and strength for floodwall integrity and safety during high flow events.

Fairfax-Jersey Creek Sheetpile Wall

The sheetpile wall that supports the riverside foreshore located between Stations 23+30 and 29+99 is visibly deteriorated and its reliability is questionable. The integrity of the sheetpile wall was assessed by URS Corporation to determine the existing condition of the wall. The evaluation identified failure of the tieback connections and extensive rusting of the structure (URS Corporation, 2004). An evaluation of the wall by the Corps determined that the foundation of the wall consisted of sands, and that the wall is passively stable without the tieback connections (Corps, 2004).

The scour potential of the Missouri River was realized during and after the Great Flood of 1993. The scour potential along the sheetpile wall was determined using USGS stream measurements taken before and after the 1993 flood to calculate the change in mean bed elevation. A scour depth of about 5-feet can be expected to occur along the sheetpile wall during severe flood events.

The risk of sheetpile wall failure was modeled and its reliability during a high water event was determined questionable. A high water event similar to 1993 would result in riverbed scour and channel degradation proportionally to the sheetpile wall and subsequent sheetpile wall failure. By the time wall failure could be detected, channel velocities would rapidly remove the foundation sands behind the wall. The rapid removal and undermining of sand bank materials would then result in failure of the foreshore bank and interior flood damage. Thus, there exists a sufficient risk of failure to consider design solutions to strengthen this portion of the Fairfax-Jersey Creek levee unit.

Fairfax-Jersey Creek Downstream Tieback

Project sponsors have requested that the Corps review the possibility of making a permanent tieback improvement at the extreme lower end of the Fairfax-Jersey Creek unit. Original project tieback measures have been compromised over the past decades. Tieback improvements may involve a short segment of 3 ft high floodwall or embankment under the Lewis & Clark viaduct area. Tieback improvements may be included as a Phase II action. The analyses conducted for this feature and resulting recommendation will be included in the Final Interim Feasibility Report and the Final Environmental Impact Statement.

North Kansas City – Harlem and National Starch

Property owners within the protected area of the levee from Station 210+00 to Station 275+00, which includes both the Harlem area and the National Starch site, reported serious floodfighting activity during the 1993 flood event. Excessive water pressures below pavement and building slabs resulted in uncontrolled piping of silt foundation blanket materials. In one building near the National Starch property, a standpipe was constructed to offset the excessive water pressure and reduce the piping potential. In another location inside of the National Starch property, sewer piping collapsed resulting in the creation of multiple sinkholes inside the protected area. The 1993 flood did not reach the top of levee in these problem areas. A full head to the top of the levee may have lead to catastrophic underseepage failure of this area and all contiguous areas inside of the North Kansas City levee unit. Similar to the East Bottoms unit, underseepage analysis and soils data indicated that effective reliability improvements in the form of underseepage control would be the required engineered solution.

Birmingham Levee Unit

Findings for the Birmingham unit in regards to overtopping, geotechnical and structural reliability indicate that this unit adequately complies with the authorization intent. This unit's performance was also determined reliable in respect to the performance level of the other units within the overall system. The current Birmingham levee unit reliability is consistent with the planning objectives of the feasibility study. Therefore, the no action alternative is the preferred alternative and no Federal improvements are recommended. Continued operation, maintenance and repair will be periodically conducted to maintain the reliability of this levee unit.

1.4 Authority

This study is being conducted under the authority provided by Section 216 of the 1970 Flood Control Act. This Act provides authority to reexamine completed civil works projects. Section 216 reads as follows:

"The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects, the construction of which has been completed and which were constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to the significantly changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying structures or their operation, and for improving the quality of the environment in the overall public interest."

Section 216 of the 1970 Flood Control Act provided continuing authority to examine completed Federal projects to determine whether the projects are providing benefits as intended.

1.5 Prior Studies

Several studies and reports have been completed pertaining to the study area and surrounding areas. These reports were used to gather information regarding the levee units and past flood events.

Operation and Maintenance Manuals:

- Argentine Unit, August, 1979
- Armourdale Unit, December, 1979
- Birmingham Unit, June, 1956
 - CID KS Unit, July, 1980

- CID MO Unit, March, 1981
 - East Bottoms Unit, January, 1978
 - North Kansas City Unit, August, 1976
 - North Kansas City Unit (Lower Section), September, 1978

Flood Plain Information Report, Kansas River, Kansas, Junction City to the Mouth, Kansas City District, U.S. Army Corps of Engineers, April 1956. This report evaluated flood hazards along the Kansas River from Junction City downstream to the confluence with the Missouri River in Kansas City, Kansas. This document examines the hydrology and hydraulics of the Kansas River Valley.

Review Report on the Kansas River, Appendix IV, Hydrology, September 1960. This report examines the hydrology on the Kansas River as part of the extensive study to review the adequacy of the Kansas River and downstream flood damage reduction systems. This study was authorized by Congress in 1953.

Senate Document No. 122, 87th Congress, 2nd Session, Kansas River and Tributaries, Kansas, Nebraska and Colorado, U.S. Army Corps of Engineers, August 1962. This is the final report submitted to Congress, which reviews the Kansas River and tributaries, Kansas, Nebraska, and Colorado, which was requested by resolution of the Committee on Public Works, United States Senate, adopted on August 20, 1953 and June 16, 1954.

The Great Flood of 1993 Post-Flood Report, Lower Missouri River Basin, Kansas City District, U.S. Army Corps of Engineers, September 1994. Appendix E of this report covers floods that occurred within the boundaries of the Kansas City District from March through August of 1993. The report presents a picture of the Great Flood of 1993 to be used in the analysis of the flood control protection system on the lower Missouri River and Tributaries.

Annual Report of Reservoir Regulation Activities, Summary for 1997-1998, Kansas City District, U.S. Army Corps of Engineers, Water Control Section. This report summarizes the 1997-1998 regulation activities at storage projects operated for flood control under direction of the Corps of Engineers, within the boundaries of the Kansas City District.

1.6 Public Involvement/Scoping

The Corps' Notice of Intent (NOI) to prepare an Environmental Impact Statement was published in the Federal Register on January 10, 2001. The Corps, in accordance with NEPA, has actively solicited input on the project. The Corps scoping process was conducted during the summer/fall of 2003 and included meetings with local, state and Federal agencies, organizations and the general public.

In addition, the Corps has established a website to provide information on the project, http://www.nwk.usace.army.mil/projects/7levees. The material contained on the Kansas Cities Levees Project website is included in Appendix A. Scoping comments are included in Appendix B. As of May 22, 2006, this website has had over 3,193 visitors. The website will be updated concurrently with the release of this DEIS. A list of agencies and organizations that have been contacted and invited to comment on the study is included in Section 7. Libraries and Corps Offices/Website are also included in Section 7.

After reviewing the comments received in response to the DIFR/DEIS, the Corps will address comments on the DIFR/DEIS, make appropriate revisions and prepare the Final Interim

Feasibility Report and Final Environmental Impact Statement (FIFR/FEIS). The Corps anticipates that the FIFR/FEIS would be released to the public during mid summer to fall of 2006. There will be a 30-day period for the public and agencies to inspect the FIFR/FEIS and the Corps' responses to comments received on the FIFR/FEIS. After this 30-day period, provided that no outstanding unresolved issues remain, the Corps would then prepare a Record of Decision.

The Public Notice regarding compliance with Section 404 of the Clean Water Act (CWA) (33 USC 1344) will be posted concurrently with the review of the DIFR/DEIS. The Public Notice and Draft CWA compliance review documents are included in Appendix H of this document.

1.7 Cooperating Agencies

The United States Environmental Protection Agency (USEPA) is a designated cooperating agency for this study. The USEPA Region VII provided hazardous, toxic, and radioactive waste (HTRW) data and mapping, an Environmental Justice evaluation in accordance with Executive Order 12898, and air quality information.

In accordance with the Fish and Wildlife Coordination Act (FWCA) as amended, the Corps has consulted with the United States Fish and Wildlife Service (USFWS) throughout the course of this study. The USFWS provided scoping comments, existing conditions information, and alternatives evaluations. The Planning Aid Letters (PALs), draft FWCA report and supplement letter received from the USFWS are included in Appendix C.

1.8 Project Sponsors

Sponsorship of the Kansas Citys Local Flood Protection Project is dispersed among five non-Federal sponsoring organizations as shown in Table 1-1.

Table 1-1. Kansas Citys Local Flood Protection Project non-Federal Sponsors

Argentine	Kaw Valley Drainage District
Armourdale	Kaw Valley Drainage District
Birmingham	Birmingham Drainage District
Central Industrial District (MO	City of Kansas City, Missouri
& KS)	Kaw Valley Drainage District
East Bottoms	City of Kansas City, Missouri
Fairfax-Jersey Creek	Fairfax Drainage District
	Kaw Valley Drainage District
North Kansas City	North Kansas City Levee District
	City of Kansas City, Missouri

2. Alternatives

2.1 Overview

To determine the adequacy of the existing flood damage reduction system hydraulic, geotechnical, structural, and risk and uncertainty analysis was conducted. The results of these analyses, and observations and effects of historic and recent flood events, were used to formulate the engineered solutions and technically feasible alternatives that could improve the flood damage reduction reliability of each respective levee unit.

Alternatives to achieve the project purpose of improving the reliability of the Kansas Citys protective works were identified at the beginning of the planning process. These alternatives were screened and refined throughout the planning process and additional alternatives were examined. Alternatives were analyzed and compared in consideration of completeness, efficiency, effectiveness, acceptability, and risk and uncertainty. Alternatives were also evaluated and compared for maximizing benefits to the National Economy and their impact on the environment. The plan with the highest net benefits is considered the NED plan, assuming technical feasibility, environmental soundness, and public acceptability (USACE, 1988).

2.2 Non-preferred Alternatives by Levee Unit.

2.2.1 Argentine Levee Unit

Kansas River Tree Removal. The existing levees along the Kansas River are the result of 1962 modifications of the original levee designs. The 1962 modifications were a result of the overtopping of the Kansas Citys units along the Kansas River in the 1951 flood. The left and right overbanks along the reach extending from river mile 3.5 to the upstream end of the Argentine unit have become overgrown with mature trees, thereby reducing the conveyance of the Kansas River from the 1962 design. The alternative of removing all of the trees throughout the Kansas Citys reach of the Kansas River (at least 185 acres) was investigated to determine the potential reduction in water surface profiles by restoring the Kansas River channel to a condition similar to that of 1962. The Corps' Hydraulic Engineering Center's River Analysis System (HEC-RAS) computer modeling was used to estimate the effectiveness of tree removal on the hydraulics of the Kansas River. Modeling results indicated that a limited improvement of conveyance is possible with the tree removal alternative. Tree removal would adversely impact riparian habitat availability along the lower Kansas River levee units. This alternative was considered less effective and less environmentally acceptable than other alternatives examined. Therefore, tree removal did not receive further consideration.

 Kansas River Tree Removal and Channel Modification. The channel modification alternative assumes that any channel modifications would include tree clearing. HEC-RAS modeling results indicated a limited conveyance improvement. Tree removal and channel modification would impact riparian habitat availability in the Argentine unit. Similar to the tree removal only alternative, this alternative was considered less effective and less acceptable than other alternatives examined. This alternative was considered less effective and less environmentally acceptable than other alternatives examined. Therefore, tree removal and channel modification did not receive further consideration.

Levee Raises. All of the proposed levee raises (nominal 500-year+0, nominal 500-year+3, and nominal 500-year+5) provide for overtopping reliability, stability and underseepage control improvements. The nominal 500-year+0 raise alternative would result in less land disturbance than the other raise alternatives. The nominal 500-year+5 raise alternative would

result in a high degree of land disturbance, hazardous waste impacts, and building and railroad trackage relocations. The effectiveness of these alternatives increases as the levee height increases. However, the 500-year+3 raise is deemed the most efficient raise because it provides the highest net economic benefits at reasonable cost. As such, the other raises were not considered.

No Action. The no action alternative is unacceptable as it does not provide for overtopping and underseepage improvements to the existing line of protection. The Argentine levee unit protects a heavily industrialized and urbanized zone of Kansas City, Kansas, which includes chemical, petroleum, and transportation-related industry. The Argentine levee, at various locations along the existing levee, could fail as a result of not implementing structural or geotechnical measures, or overtopping reliability improvements. In the absence of Federal action addressing levee improvements, a high water event could result in the release of a variety of industrial chemicals and significantly impact the natural and human environment within and downstream of this unit. Levee failure would result in significant impacts to a water quality, fisheries and wildlife, extensive property damage and potential loss of human life. Significant impacts to the National economy could occur as one of the busiest railyards in the United States would be at least temporarily shutdown. This alternative was considered less effective and less environmentally acceptable than other alternatives examined. Therefore, the no action alternative did not receive further consideration.

2.2.2 Armourdale Levee Unit

The preliminary alternatives formulated for the Armourdale thus far are presented below. No alternatives have been screened out. Engineering, economic, and environmental analyses are ongoing. All of the alternatives formulated for this unit will be discussed in the final feasibility report (FFR) and the final environmental impact statement (FEIS).

Flood Fight. The flood fight alternative requires a stockpile of sandbags to be stored near areas with high uplift potential and areas observed in the 1993 flood to have a high probability of overtopping. However, floodfighting is an unreliable and unacceptable alternative compared to engineered solutions, as flood fighting would not prevent underseepage failure. Therefore, the flood fight alternative did not receive further consideration.

Landside Levee Raise and Floodwall Modification or Replacement. As discussed in section 1.2.2, the existing flood protection of the Armourdale unit is primarily earthen levee and floodwall. Preliminary alternatives formulated for this unit include raise scenarios of 500+0, 500+1, 500+2, and 500+3. Floodwalls would be modified or replaced. I-walls would be installed near the top of the levee in areas of proposed levee raises with insufficient real estate for landside expansion. In addition to levee and floodwall modifications, these raises may include pump plant modification and/or replacement, and the installation of relief wells or a buried collector system to relieve underseepage pressures. No raise scenarios have been screened out for the Armourdale unit.

No Action. The no action alternative is unacceptable as it does not effectively provide for reliability improvements designed to prevent overtopping and underseepage failure of the Armourdale unit. Failure of this levee unit would result in significant impacts to the natural and human environment within, and downstream of this unit. Levee failure would result in the release of a variety of industrial chemicals adjacent and downstream of this unit that would cause significant impacts to water quality and fisheries and wildlife. In addition to economic impacts from business closures and property damage, Armourdale has a relatively high percentage of minority and low income residents and sensitive populations that would be significantly

impacted by levee failure and the resulting business closures, property damage, and the potential loss of human life. Therefore the no action alternative did not receive further consideration.

2.2.3 Central Industrial District Levee Unit

The preliminary alternatives formulated for the CID-Kansas unit thus far are presented below. No alternatives have been screened out. Engineering, economic, and environmental analyses are ongoing. All of the alternatives formulated for this unit will be discussed in the final feasibility report and the final environmental impact statement (FEIS).

Flood Fight. The flood fight alternative requires a stockpile of sandbags to be stored near areas observed in the 1993 flood to have a high probability of overtopping. However, floodfighting is an unreliable and unacceptable alternative compared to engineered solutions, as flood fighting would not prevent underseepage failure.

Landside Levee Raise and Floodwall Modification or Replacement. The existing flood protection of the CID unit is primarily earthen levee and floodwall. Preliminary alternatives for this unit include raise scenarios of 500+0, 500+1, 500+2, and 500+3 to improve overtopping reliability. Floodwalls would be modified or replaced. No I-walls would be installed for the CID levee improvements. Pump plants, relief wells, and a buried collector would provide underseepage control. No raise scenarios have been screened out for the Central Industrial District.

No Action. As its name implies, the Central Industrial District is a heavily industrialized unit that contains many businesses that conduct a variety of manufacturing processes. The no action alternative is unacceptable as it does not provide for overtopping and underseepage improvements to increase the reliability of the existing protection. The no action alternative could result in levee failure, which would significantly impact the natural and human environment within and downstream of this unit. Levee failure would result in extensive property damage, unemployment, significant impacts to water quality, fisheries and wildlife, and the potential loss of human life.

2.2.4 East Bottoms Levee Unit

Flood Fight. The flood fight alternative requires the storage of 4,000 sand bags on site to be placed in areas observed in the 1993 flood to have a high probability of underseepage risk. This alternative is the least expensive with no engineering effort required. However, floodfighting is an unreliable and unacceptable alternative compared to engineered solutions, as flood fighting would not prevent underseepage failure. Therefore, the flood fight alternative did not receive further consideration.

Sheetpile Wall. The sheetpile wall alternative would consist of installing approximately 232,500 square feet of sheetpiling down to bedrock (approximate 75 foot depth) along the riverside toe from Station 396+00 to 427+00 to control underseepage during flood events. This alternative would extend the seepage path of water that seeps through the soil to the toe of the levee, and construction could be completed within the existing right-of-way, outside of all existing SWMUs. However, sheetpile installation is a relatively expensive alternative that is less effective for underseepage control than the installation of pressure relief wells. In addition to the high expense of materials and labor, variable bedrock depth could complicate the installation process and considerably increase the cost of effectively implementing this alternative. This alternative was considered less effective and less environmentally acceptable than other alternatives examined. Therefore, this alternative did not receive further consideration.

Slurry Cut-Off Wall. This alternative would consist of constructing a 3-foot wide slurry wall to bedrock depth (approximately 75 feet) along the riverside toe from Station 396+00 to 427+00 to control underseepage during flood events. The variables associated with slurry cut-off wall construction are similar to sheetpile wall construction. This alternative would extend the seepage path of water that seeps through the soil to the toe of the levee, and construction could be completed within the existing right-of-way, outside of all existing SWMUs. A slurry wall is a relatively expensive alternative, and the costs associated with construction could greatly increase due to variable bedrock depth. The performance of a slurry cut-off wall is wholly dependent upon construction quality. This alternative was considered less effective and less environmentally acceptable than other alternatives examined. Therefore, the slurry cut-off alternative did not receive further consideration.

No Action. The no action alternative is unacceptable as it would not provide a means of controlling seepage through the levee. A high water event could result in conditions similar to those observed in 1993. Multiple sand boil formation, excessive seepage, and landside piping could compromise the integrity of the levee. The Blue River typically rises fast during high water events. If water reaches the top of the levee, particularly between stations 365+00 and 435+00, catastrophic underseepage failure of the levee could occur. Chemicals used in various manufacturing process chemicals could enter the Blue and Missouri Rivers, thereby impacting water quality, fisheries and wildlife. Levee failure could result in unemployment and adverse economic impacts on the regional economy. This alternative was considered less effective and less environmentally acceptable than other alternatives examined. Therefore, the no action alternative did not receive further consideration.

2.2.5 Fairfax-Jersey Creek Levee Unit

There are two features requiring flood damage reduction reliability improvements within the Fairfax-Jersey Creek levee unit. These include the Board of Public Utilities floodwall and the Fairfax-Jersey Creek sheetpile wall.

Board of Public Utilities Floodwall

Flood Fight. Floodfighting would be accomplished by sandbagging sections of floodwall displaced by floodwaters. Floodfighting is not considered a viable alternative because it is not an effective solution for potential floodwall failure. This alternative was considered less effective and less environmentally acceptable than other alternatives examined. Therefore, the flood fight alternative did not receive further consideration.

New Floodwall. The existing floodwall would be perforated at utilities locations to provide more hydrologic control of the wall under extreme flood conditions. A new floodwall constructed landside of the existing floodwall would include a higher capacity pile system and stronger structural elements. The new floodwall would connect to the existing wall at utilities locations. There is a limited area available for new floodwall construction, primarily due to the extensive utilities located in the area of Stations 290+00 to 295+00. In addition to the limited space and numerous utilities relocations, a new floodwall would be very expensive due to the large amount of excavation, raw materials and labor required. This alternative was considered less effective and less environmentally acceptable than other alternatives examined. Therefore, this alternative did not receive further consideration.

Foundation Soil Modification with Jet Grouting. Jet grouting or pressure grouting is used in a variety of construction applications to modify soil properties, but it is not considered a long-term, viable solution for floodwall strengthening. Jet grouting was used on flood damage

reduction features after the 1993 flood with very limited success. Due to the limited shear capacity of the existing concrete piles, the entire floodwall foundation (4,039 feet) would require grout injection. In addition to the questionable effectiveness of jet grouting, controlling the pressure of the injection to simultaneously achieve sufficient grouting without damaging existing utilities and water intakes would be difficult. This alternative was considered less effective and less environmentally acceptable than other alternatives examined. Therefore, this alternative did not receive further consideration.

Temporary Earthen Fill. This alternative consists of placing earthen fill behind the floodwall as water rises and removing it when high water recedes. Temporary earthen fill is not considered a viable alternative, because the weight of the fill needed for effective flood damage reduction would excessively stress the structural components of the wall. Therefore, this alternative did not receive further consideration.

Construct New Earthen Levee Adjacent to the Existing Floodwall.

Permanently establishing an earthen levee adjacent to the existing floodwall is not considered a feasible alternative due to insufficient space available for levee construction. Therefore, this alternative did not receive further consideration.

No Action. The no action alternative is unacceptable because it does not provide for improvements that would increase the structural reliability of the floodwall during a flood event. The Board of Public Utilities floodwall protects an energy production and drinking water treatment facility. In the absence of a Federal action, drinking water, utilities, Missouri River water quality, fish and other aquatic organisms could be significantly impacted by a failed floodwall depending on the extent of flooding. Floodwall failure would result in soil and portions of the floodwall entering the Missouri River. A high water event could also result in broken pipelines and the release of water treatment chemicals, waste and other deleterious material into the adjacent riparian area, wetlands, and waterway. Floodwall failure could also result in unemployment and the potential loss of human life. This alternative was considered less effective and less environmentally acceptable than other alternatives examined. Therefore, the no action alternative did not receive further consideration.

Fairfax-Jersey Creek Sheetpile Wall

Flood Fight. Although flood fighting is the least expensive alternative, it is not considered an effective solution because the reaction time to failure is considered unachievable. Based upon geotechnical risk analysis, catastrophic failure of the sheetpile wall would occur before any flood fight efforts could be mobilized to provide protection. This alternative was considered less effective and less environmentally acceptable than other alternatives examined. Therefore, the flood fight alternative did not receive further consideration.

Construct a Closed Cell Sheet Pile Wall Landside of the Existing Wall. New sheetpile would be driven landside of the existing wall by a crane and existing sheetpile would be removed at wall intersections. The open and closed cell designs are practical solutions, with the difference being cost and level of reliability. Closed cell construction is considered more reliable, but is more expensive than the open cell design due to the additional lengths of sheetpile required to close the cells. The open cell solution provides the reliability required at a lower cost for effective flood protection. Therefore, this alternative did not receive further consideration.

Construct a New Wall Using Auger Cast Piles and Tiebacks. Piles would be placed landside of the existing sheetpile wall. A top cap comprised of concrete would be cast on top of the piles, and the tiebacks would be grouted into the soil. This alternative would incur

construction costs much greater than the preferred open cell wall design due to the difficult procedures required to ensure internal tensioning of the support structures for proper installation. Therefore, this alternative is less acceptable than the installation of a closed cell sheetpile wall. This alternative was considered less effective and less environmentally acceptable than other alternatives examined. Therefore, this alternative did not receive further consideration.

No Action. The no action alternative is unacceptable as it would not provide a means to stabilize the land behind the existing floodwall. In the absence of a Federal action, scouring at the toe of the existing sheetpile wall could result in catastrophic underseepage failure of the wall during a high water event. Sheetpile wall failure would result in a large portion of the right bank of the Missouri River sloughing into the River thereby comprising the adjacent land and structures and impacting water quality and fish and other aquatic organisms due to an increase in sediment bed load and solids within the water column. Recreation could also be adversely impacted by sheetpile wall failure. Kaw Point Park is located downstream of the sheetpile wall. A significantly greater construction effort, resulting in increased noise, dust, and emmissions would be required to repair the riverbank relative to just driving a new sheetpile wall. This alternative was considered less effective and less environmentally acceptable than other alternatives examined. Therefore, the no action alternative did not receive further consideration.

2.2.6 North Kansas City Levee Unit - Harlem

Flood Fight. Implementing the flood fight alternative would require stockpiling 2,000 sandbags to be placed in areas observed to exhibit high uplift during the 1993 flood. Floodfighting with sandbags is the least expensive alternative and it can be accomplished within the existing right-of-way. Floodfighting is not the preferred alternative for this levee unit, because it is not an effective solution for flood damage reduction. Sandbag placement would not effectively relieve underseepage pressures and uplift would continue during high water events. This alternative was considered less effective and less environmentally acceptable than other alternatives examined. Therefore the flood fight alternative did not receive further consideration.

Landside Seepage Berm. Constructing two seepage berms measuring 200 feet wide and 350 feet wide, to control underseepage during a flood event is an effective and relatively reliable alternative. Direct construction costs associated with this alternative are moderate. However, indirect costs such as extending the right-of-way, conducting subsurface investigations, structural demolition, and relocating utilities, residences and businesses greatly increase the total cost and the logistics associated with this alternative. Constructing a landside seepage berm would disrupt the local community the greatest due to the short-term and long-term implications of implementing this alternative. This alternative was considered less effective and less environmentally acceptable than other alternatives examined. Therefore, this alternative did not receive further consideration.

Pressure Relief Wells. This alternative consists of installing stainless steel relief wells to a depth of approximately 75 feet along the levee toe about 200 feet apart. Relief wells would collect the seepage and portable pumps would be used to pump seep water over the levee via access provided by six manholes. A permanent right-of-way is not required as this alternative can be implemented with a temporary construction easement. Relief wells are a highly effective mechanism used to prevent seepage. However, pressure relief well performance is highly dependent upon the quality of construction, and the long-term maintenance costs associated with this alternative are greater than installing a buried collector system. Therefore, this alternative did not receive further consideration.

No Action. The no action alternative is unacceptable as it does not provide a means to control underseepage through the levee. In the absence of implementing the preferred alternative to control seepage through the levee, a high water event could result in conditions similar to those observed in 1993 for North Kansas City. Catastrophic underseepage failure of the levee would flood North Kansas City and release large amounts of sediment and manufacturing chemicals and materials into the Missouri River. Due to the major residential, commercial and industrial development in the City of North Kansas City, Missouri, the no action alternative could result in significant adverse affects to the economy due to unemployment and the potential loss of human life. Therefore, the no action alternative did not receive further consideration.

2.2.7 North Kansas City Levee Unit- National Starch

Flood Fight. The flood fight alternative requires a stockpile of 109,200 sand bags on site to be placed near areas that exhibited high uplift during the 1993 flood. Flood fighting requires the least short-term cost and this alternative does not require extending the existing right-of-way. However, flood fighting is not an effective solution as a high potential for flood damage remains after implementing this alternative. Therefore, the flood fight alternative did not receive further consideration.

Landside Seepage Berm. Landside seepage berm construction is a very expensive alternative with many negative aspects. A landside seepage berm is not as effective as pressure relief wells in relieving foundation pressures and the costs of extending the right-of-way, modifying structures, and relocating structures are very high. Additional considerations include:

 Structural demolition and disposal would require an assessment of the need for a regulated disposal site.

• Subsurface investigations would be required to identify blanket thickness for berm design refinement and to develop more reliable underseepage flow quantities for well design.

 National Starch plant operations could require a temporary shutdown, thereby potentially impacting the local community and economy.

• Land disturbance would total approximately 23 acres.

Because other alternatives were considered less expensive and more effective, this alternative did not receive further consideration.

Buried Collector System. A buried collector was deemed technically inadequate for this site because the significant underseepage pressures that have been observed at the site extend beyond the typical zone of influence of a buried collector. An alternative that increases the effectiveness of handling the underseepage pressures experienced at the National Starch site consists of pressure relief wells and a pump station. Therefore, this alternative did not receive further consideration.

No Action. The no action alternative is unacceptable as it does not provide for control of underseepage through the levee and the effective means to return seepwater into the Missouri River. Catastrophic underseepage failure at the National Starch site could result in flooding North Kansas City. Significant impacts to water quality and fish and other aquatic organisms would occur with the release of large amounts of sediment and manufacturing chemicals and materials into the Missouri River. Due to the major residential, commercial and industrial development in the City of North Kansas City, Missouri, the no action alternative could result in substantially adversely affecting the economy due to unemployment and the potential loss of human life. Therefore, the no action alternative did not receive further consideration.

2.2.8 Birmingham Levee Unit

The engineering analyses conducted for the Birmingham unit indicated that the overtopping, geotechnical and structural reliability of this unit adequately complies with the original authorization intent. Therefore, no alternatives were proposed for this levee unit. The no action alternative was considered the preferred alternative for the Birmingham levee unit.

2.3 Preferred Alternative by Levee Unit

The Recommended Plan is the combination of preferred alternatives for each of the levee units that provide effective overtopping and underseepage control. The selected alternatives for the levee units are presented below in Table 2-1. Descriptions of the preferred alternatives are discussed in sections 2.3.1 through 2.3.9.

Table 2-1. Levee Unit Preferred Alternatives

Levee Unit	Preferred Alternative
Argentine	Nominal 500+3 levee raise alternative including underseepage control measures.
East Bottoms	Pressure relief wells.
Fairfax-Jersey Creek Floodwall	Floodwall strengthening with an additional row of piles and a foundation slab extension.
Fairfax-Jersey Creek Sheetpile Wall	Open cell, driven sheetpile wall.
North Kansas City - Harlem	Buried collector system.
North Kansas City - National Starch	Pressure relief wells and a pump station.
Armourdale	The tentatively preferred alternative is the nominal 500-year+3 ft. levee raise with underseepage controls.
Central Industrial District	The tentatively preferred alternative is the nominal 500-year+3 ft. levee raise with underseepage controls.
Birmingham	No action alternative.

2.3.1 Argentine Levee Unit

Nominal 500-year+3 Levee Raise Including Underseepage Controls.

The preferred alternative for the Argentine unit is the nominal 500-year+3 levee raise to improve overtopping reliability with pump station and levee improvements to increase stability and provide underseepage control. The nominal 500-year+3 levee raise alternative provides the greatest level of protection at the most economical cost and has been identified as the NED plan. Levee improvements consist of the modification or replacement of 3 pump stations followed by 6 different types of levee modifications to include floodwalls, I-walls, stoplog gaps, top cap raise, landside levee raise with berm, and landside levee raise with no berm (Figures 1-2 through 1-6). A rock toe would be constructed in areas of railbed congestion to avoid costly railbed displacement. Argentine levee unit improvements were primarily determined through existing conditions, underseepage and stability analyses, the avoidance of impacts to HTRW, and the avoidance of impacts to the Argentine riparian foreshore. The nominal 500-year+0 levee raise requires less land disturbance than the other raise alternatives as the toe of the new levee would not extend as far landward as the nominal 500-year+3 and nominal 500-year+5 alternatives.

Less borrow would be required for this raise, and impacts to wetlands would be avoided. Wetland impacts are discussed in sections 3.2.2 and 4.11. Impacts to HTRW are avoided with the nominal 500-year+0 and are avoided or otherwise minimized for the nominal 500-year+3 raise alternative. The nominal 500-year+5 raise alternative would require more real estate, land disturbance, and potential HTRW impacts than the nominal 500-year+0 and nominal 500-year+3 raises. All of the raise alternatives avoid impacts to the Argentine foreshore.

2.3.2 Armourdale Levee Unit

The tentative preferred alternative for this unit is the nominal 500-year+3 landside levee raise, which includes underseepage control improvements, to provide equal levels of protection among the Kansas River units. The existing flood protection of the Armourdale unit is primarily earthen levee and floodwall. This raise would include increasing the height of the existing earthen levee and floodwall replacement. I-walls would be installed near the top of the levee in areas of proposed levee raises with insufficient real estate for landside expansion. In addition to levee and floodwall modifications, this raise could include pump plant modifications and/or replacement, and the installation of relief wells or a buried collector system to relieve underseepage pressures. I-walls would be constructed in the levee crest. Floodwall excavation would occur up to approximately 50 feet landward of the toe of the existing levee. The placement of borrow soil would occur up to about 75 feet landward of the toe of the existing levee for the earthen levee raise.

2.3.3 Central Industrial District Levee Unit

The tentative preferred alternative is the nominal 500-year+3 landside levee raise, which includes underseepage control improvements, to provide equal levels of protection among the Kansas River units. The existing flood protection of the CID unit is primarily earthen levee and floodwall. This raise would include increasing the height of the existing earthen levee and floodwall replacement. No I-walls would be installed for the CID levee improvements. Pump plants, relief wells, and a buried collector would provide underseepage control. The placement of borrow soil would occur up to about 75 feet landward of the toe of the existing levee for the earthen levee raise.

2.3.4 East Bottoms Levee Unit

Pressure Relief Wells. Relief wells would be installed along the toe of the levee between Stations 405+00 and 420+00 (Figure 1-9). This alternative is an augmentation to an existing collector system. Relief wells provide an effective solution to control underseepage that can be completed within the existing right-of-way. To perpetuate reliability, routine well maintenance would be conducted annually and complete well replacement would be required approximately every 40 years. Relief wells are a more cost-effective solution that requires less excavation and land disturbance than implementing a sheetpile wall or slurry cut-off wall as a preferred alternative. Relief wells and a buried collector system have a similar construction footprint and would result in an equitable land disturbance of about two acres. Although a buried collector system would be a more economical alternative, it does not meet technical requirements for this unit as relief wells can relieve pressure to a lower level than a buried collector system. Therefore, relief wells provide a higher level of protection against underseepage pressures and levee failure than a buried collector and are considered the environmentally preferred alternative.

2.3.5 Fairfax-Jersey Creek Levee Unit Board of Public Utilities Floodwall Additional Row of Piles and Foundation Slab Extension. An additional row of auger cast piles would be installed on the landward side of the pile cap. A foundation slab extension would be implemented to facilitate pile installation. Additional piles and the slab extension

would be installed the entire length of the existing floodwall between Stations 287+85 and 302+32 (Figure 1-10). The preferred alternative is considered the environmentally preferred alternative. This alternative requires less long-term land disturbance than a temporary earthen fill, as the fill would need to be placed during high water events and subsequently removed. Constructing a new earthen levee adjacent to the existing floodwall would require a similar degree of disturbance as the preferred alternative, as both of these alternatives would require construction along the entire length of the existing floodwall. Foundation soil modification with jet grouting would require less land disturbance than the aforementioned alternatives, but the long-term effectiveness of this alternative is questionable.

A new floodwall constructed landside of the existing floodwall would require a greater land disturbance than the preferred alternative due to a larger footprint required for construction and numerous utilities relocations. Pumphouse Number 1, an abandoned, historic structure that is potentially eligible for listing on the National Register of Historic Places (NRHP), would likely require demolition or receive incidental construction damage as a result of new floodwall construction.

All of the alternatives would require the basement of the abandoned pump house to be filled with sand and the lines grouted closed to prevent any water from backflowing into the basement from the water intake and damaging the structure.

2.3.6 Fairfax-Jersey Creek Levee Unit Sheetpile Wall

Open Cell Sheet Pile Wall Landside of the Existing Wall. The open cell design is the most economical alternative that provides the required flood protection reliability. Sheetpile would be driven into the existing stability berm landside of the existing sheetpile wall between Stations 23+30 and 29+99 using a crane deployed on a barge (Figure 1-11). A driven sheetpile system forgoes the need for tieback anchors, thereby reducing the cost of this alternative, and decreasing the amount of land disturbance required for construction. The open and closed cell sheetpile wall designs require a similar land disturbance for installation, so either could be considered the environmentally preferred alternative. Using an open cell sheetpile wall as the preferred alternative is more economical than both the closed cell sheetpile wall design and constructing a sheetpile wall using auger cast piles and tiebacks, while providing wall stability and flood protection reliability.

2.3.7 North Kansas City Levee Unit - Harlem

Buried Collector System. An underground water collection system consisting of perforated pipe would be installed the full length of the levee between Stations 212+00 to 239+40 along the landside toe to intercept seepage (Figure 1-12). Six manholes would be placed along the system to collect the seepwater. Portable pumps would pump the seep water over the levee.

A buried collector system at this location is considered to be a more appropriate alternative than a series of relief wells and a pump station, because the underseepage pressures measured do not necessitate relief wells at this location. The landside seepage berm alternative would result in the construction of two berms measuring 200 feet wide and 350 feet wide would cause the most land and social disturbance as structural demolition and the relocation of utilities, residences, and business would be required for this alternative. A buried collector does not require new right-of-way, as a temporary right-of-way would suffice for construction requirements. Buried collector installation and relief well installation and pump station construction would result in similar construction impacts. The primary benefits of a buried collector system relative to pressure relief wells at this location include the cost savings

associated with long-term maintenance and the protection of piping at the levee toe. Therefore, a buried collector can be considered the environmentally preferred alternative.

2.3.8 North Kansas City Levee Unit - National Starch

Relief Wells and Pump Station. Pressure relief wells and a pump station would be installed into the existing stability berm along the toe of the levee between Stations 255+95 and 274+10 (Figure 1-13). Installing relief wells at this location would provide a highly effective mechanism to control underseepage. To perpetuate reliability, routine well maintenance would be conducted annually and total well replacement would be required approximately every 40 years. A buried collector system does not meet the technical requirements for this levee unit, as it cannot relieve pressure to the required level, as provided by pressure relief wells. Installing relief wells and a pump station would not require a potential temporary shutdown of the National Starch plant, utilities or structures modifications and/or relocations. Relief well and pump station installation are more economical and induce less impacts than seepage berm construction. Although additional real estate would be acquired for a construction easement and a permanent inspection/maintenance easement, land disturbance would be limited to 2 acres, as opposed to the 23-acre land disturbance associated with seepage berm construction. A similar land disturbance would result from the construction of relief wells and a pump station or a buried collector. Installing relief wells and a pump station is considered the environmentally preferred alternative compared to a buried collector because it is more effective at preventing underseepage failure than a buried collector.

2.3.9 Birmingham Levee Unit

No Action. Findings for the Birmingham unit in regards to overtopping, geotechnical and structural reliability indicate that this unit adequately complies with the authorization intent. This unit's performance was also determined reliable in respect to the performance level of the other units within the overall system. The current Birmingham levee unit reliability is consistent with the planning objectives of the feasibility study. Therefore, the no action alternative is the preferred alternative, and no Federal improvements are recommended. Continued operation, maintenance and repair action will be periodically conducted to maintain the reliability of this levee unit.

3. Affected environment

1142 3.1 Physical-Chemical Environment 1143 3.1.1 Geology and Minerals

The project area is predominantly an alluvial floodplain underlain by bedrock of the Pennsylvanian System, Kansas City Group. Pennsylvania strata generally consist of interbedded sandstone, shale, limestone, clay, and coal. Limestone is the most abundant resource present in the Kansas City Group, and it is locally mined for materials primarily used for road and highway construction.

In addition to limestone, sand and gravel are locally important mineral resources. The historic production of these resources is from floodplain and in-channel deposits of major streams. Crushed limestone has replaced stream gravels as the predominant coarse aggregate in cement. Upland terrace and glacial deposits are important sources of sand and gravel in the southeastern and northwestern portions of Missouri. The counties located within the study area are considered major producers of crushed stone, and construction sand and gravel.

3.1.2 Water Resources and Water Quality

Water resources within the Kansas Citys Local Flood Control Project area include portions of the Missouri, Kansas, and Blue Rivers, Jersey Creek; Rock Creek; and Barber Creek. The Missouri River drainage upstream of Kansas City measures approximately 489,162 square miles. The drainage upstream of Sioux City, Iowa, near Gavins Point Dam, is approximately 314,617 square miles. Smithville Lake controls about 213 square miles of the Little Platte River tributary drainage in Missouri. Except for Smithville Lake and groups of small lakes in the vicinity of Lincoln and Omaha Nebraska, the drainage between Gavins Point and the Kansas Citys is uncontrolled. The uncontrolled drainage area downstream of the lowermost main stem dam and upstream of the Kansas Citys measures about 174,332 square miles.

The Kansas River basin upstream of Kansas City, Kansas, contains about 60,060 square miles of surface area. Approximately 59,154 square miles of this area is modified by reservoirs. As previously discussed, 18 reservoirs within the Kansas River basin impact the flows at Kansas City. The Kansas River basin and associated tributaries are predominately located in a wide valley of well-developed agricultural lands used for general agriculture.

The Kansas River is a major right-bank tributary of the Missouri River that begins at the confluence of the Republican River and Smoky Hill Rivers near Junction City, Kansas. The Kansas River flows 170.5 miles to its mouth in Kansas City, Kansas, where it joins the Missouri River at river mile 367.4 between the Fairfax-Jersey Creek and Central Industrial District Levee Units.

The Blue River is a major right-bank tributary of the Missouri River located at river mile 358.0, adjacent to the East Bottoms Levee Unit. The Blue River is formed by the confluence of Wolf Creek and Coffee Creek in eastern Kansas and measures approximately 40 miles long with a watershed of about 270 square miles.

Jersey Creek is an intermittent tributary of the Kansas River located adjacent to the Missouri Pacific Railroad in the highly urbanized watershed of the Central Industrial District, just north of the confluence of the Missouri and Kansas Rivers. Barber Creek is an intermittent stream that enters the Kansas River at river mile +/- 9.9, upstream of the Turner Memorial Bridge. Rock Creek is mapped as a perennial stream that enters the Missouri River at river mile +/- 356.9 via an old Missouri River channel.

In accordance with the Clean Water Act, states are responsible for adopting water quality standards for their jurisdictions. Water quality standards are used to establish water quality criteria to protect and maintain the designated uses of water resources. Section 305(b) of the Clean Water Act requires states to produce water quality inventories that assess progress in achieving water quality objectives. Section 303(d) of the CWA requires that each state identify waters that are not meeting water quality standards and for which adequate water pollution controls have not been required.

The origination of water pollution is generally divided into point and nonpoint sources. Point source pollution originates from a specific location and is generally easy to identify and control (i.e., sewage treatment and manufacturing plants). Nonpoint source pollution originates from diverse sources such as agricultural and urban areas and is not generally traceable to a specific source. Common pollutants of the water resources within the study area include sediment, nutrients, bacteria, pesticides, and various hazardous materials (solvents, industrial wastes, etc.). However, these materials and their constituents are generally present in levels that do not exceed the standards promulgated by the states of Missouri and Kansas.

Project area water resources that are 303(d) listed as impaired waters by MDNR and KDHE include the Missouri River, Kansas River, and Blue River. The inclusion of these resources as impaired waters is related to the protection of warm water aquatic life and human health and is associated with fish consumption advisories due to contaminants in fish tissue exceeding current acceptable standards. Jersey Creek water quality is assessed by KDHE, but it is not a 303(d) listed stream.

The Missouri River segment within the project area is 303(d) listed as impaired due to excess levels of chlordane and polychlorinated biphenyls (PCBs). Chlordane is a pesticide that primarily enters surface waters primarily through urban and agricultural runoff. PCBs are industrial compounds that enter surface water via both point and nonpoint sources.

The Kansas River segment within the vicinity of the project area is 303(d) listed as impaired due to an excessive copper concentration. Copper is a point and nonpoint source pollutant. Concentrations exceeding water quality standards are generally related to the transport of sediment, especially under high flow conditions.

The Blue River segment within the project area is 303(d) listed as impaired due to excess levels of chlordane. The Missouri Clean Water Commission classified the Blue River as a "Metropolitan No-Discharge Stream" in 1967. This designation has prevented new point sources from being permitted to discharge into the river, although existing discharges continued to be permitted.

Jersey Creek, Barber Creek, and Rock Creek water quality is assessed by KDHE, but these were not listed as 303(d) streams.

3.1.3 Air Quality

In accordance with the Clean Air Act, the USEPA set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to the environment and public health. The six principal pollutants, also known as "criteria" pollutants, include: ozone, lead, particulate matter, carbon monoxide, nitrogen dioxide, and sulfur dioxide.

Air quality in Kansas and Missouri currently meets the USEPA's accepted levels of criteria pollutants. Kansas City, like other metropolitan areas, has experienced ozone problems since the late 1970s. The Kansas City area was designated a submarginal ozone attainment area under the Clean Air Act Amendments of 1990. Ozone nonattainment was primarily attributed to both stationary and mobile emissions. After demonstrating compliance with the ozone standard in 1992, the Kansas City area was redesignated to attainment and the area encompassing Clay, Jackson and Platte Counties in Missouri and Johnson and Wyandotte Counties in Kansas was included in the Kansas City ozone maintenance area. The original Kansas City Maintenance Plan for Control of Ozone for Missouri and Kansas was approved by the USEPA on June 23, 1992.

On January 13, 2004, the USEPA approved the Kansas City Ozone Maintenance Plan—Second Ten Year Plan for Kansas and Missouri as part of each State's Implementation Plan (SIP) for Clean Air Act compliance to maintain the ozone standard and attainment status. There are currently several air quality-monitoring sites in the Kansas City area that monitor a variety of pollutants in addition to criteria pollutants for NAAQS compliance. Ozone standards are measured in one-hour and eight-hour averages. Although Kansas City's air quality is currently in compliance with all NAAQS, modeling conducted by the states of Kansas, Missouri and Mid America Regional Council in 2004 illustrates the area's sensitivity to emissions of ozone precursors of volatile organic compounds (VOCs) and nitrogen oxides (NOx).

USEPA redesignated Johnson, Linn, Miami, and Wyandotte Counties in Kansas, and Cass, Clay, Jackson, and Platte Counties in Missouri to attainment for the 8-hour ozone standard in 2005 (Federal Register, Volume 70, No. 27). This redesignation was proposed as a result of attaining 8-hour ozone NAAQS compliance for the 2001-2004 timeframe.

3.1.4 Noise

Ambient noise levels are generally dependent upon the level of urban development and associated activities conducted within a given area. Noise levels can range from low to high due to the highly developed nature of the project area, which includes major industry and associated access routes via highways and roads, rail lines, and an airport. Ambient noise levels within the project area are variable and generally dependent upon the type and level of activity occurring in a particular portion of the study area within a certain timeframe. Existing noise within the project area includes but is not limited to railroad, aircraft and vehicular traffic, industrial processes, construction and agricultural activities. Potential sensitive noise receptors include residences, parks, churches, schools, hospitals, hotels, and libraries.

3.1.5 Visual Quality

The project area is heavily industrialized and primarily includes features of low to moderate aesthetic value. The majority of the landscape is dominated by industry adjacent to the existing levee system. Areas with established communities are located near industrial development. The Kansas and Missouri Rivers within the project area contain floodplain forest, sand bars, islands, and bluffs, which provides natural diversity to the river corridor landscapes. Cropland, grassland, and forested land are established in portions of the rivers' floodplains.

Existing levees and flood damage reduction mechanisms that have been installed to prevent bank or levee erosion (i.e., sheet piling, floodwalls, rip-rap) interrupt the natural character of the river systems. However, flood damage reduction features have been in-place for many years and in many instances may blend with the riverscape and adjacent development. Armoring with rock rip-rap is an example of introducing materials that do not naturally occur within the river corridors and may be considered aesthetically displeasing to recreational river

users. The contrast of rip-rap and other flood damage reduction features within a river corridor generally becomes less evident over time with the process of weathering and the establishment of vegetation.

Soils within the project area have primarily developed as a result of the wind-borne

3.1.6 Soils and Prime Farmland

deposition of fine-grained material (loess) and the deposition of material on land by streams (alluvium). Loess deposits are visible on the exposed valley walls adjacent to the Missouri River. Missouri River floodplain soils belong to the Haynie-Urban land-Leta association, and the Onawa-Haynie-Eudora association characterizes Kansas River soils. Both soil associations generally consist of deep, nearly level, well drained to somewhat poorly drained soils comprised of river-deposited sand, silt, and clay.

Numerous soil series are located within the proposed project area. Prime farmland is defined by the USDA-NRCS as land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It has the soil quality, growing season, and moisture supply needed to produce economically sustained high yields of crops when treated and managed according to acceptable farming methods, including water management. Prime farmland generally has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, acceptable salt and sodium content, and few or no rocks. Prime farmland is permeable to water and air, is not excessively erodible or saturated with water for a long period of time, and either does not flood frequently or is protected from flooding. Prime farmland can be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas (SSM, USDA Handbook No. 18, October 1993). Prime farmland within the project area is dominated by, but is not limited to the Haynie, Leta, Gilliam, and Eudora soils series.

Mapped soil units within the proposed borrow area include Haynie silt loam, Eudora complex, and Sarpy-Haynie complex (Zavesky and Boatright, 1977). Haynie silt loam and Eudora complex soils are considered prime farmland. The Sarpy-Haynie complex is classified as farmland of statewide importance. Therefore, most soil units within the proposed borrow area are mapped as prime farmland.

3.1.7 Hazardous Waste Management

The Kansas Citys levee project encompasses a large area of highly industrialized and commercialized property. In such highly industrialized areas, hazardous waste can be present on properties that are adjacent to levees.

The HTRW Site Assessment performed as part of the Feasibility Study evaluates the HTRW areas of concern with respect to the proposed Feasibility Study alternatives. This assessment identifies the nature and extent of contamination, which could directly impact the proposed Feasibility Study alternatives. The assessment includes a document search, a site evaluation, and a field investigation for select areas.

To identify all the HTRW areas of concerns, the following activities were performed as part of the document search and site evaluation:

 • Reviewed the Reconnaissance Report – HTRW Assessment dated August 1999 and the corresponding database search dated January 22, 1999.

 Reviewed the HTRW Follow-up Investigation dated November 1999 and the corresponding database search dated September 1999.

- Reviewed information obtained from an USEPA and KDHE website database searches.
- Reviewed documents obtained from USEPA Region VII files and conducted personal interviews with EPA representatives concerning Harcros Chemical, Inc. and Sinclair Oil.
 - Reviewed documents obtained from KDHE files and conducted personal interviews with the KDHE representatives concerning Burlington Northern Santa Fe Railroad (BNSF) and Fairbanks Morse Pump Corporation.
 - Reviewed documents and information obtained from BNSF Railroad and met with BNSF Railroad representatives.
 - Reviewed information provided by Board of Public Utilities (BPU) for the Quindaro Power Plant and met with BPU representatives.
 - Reviewed documents obtained from Bayer Corporation and met with Bayer representatives.
 - Met with MDNR to discuss the Feasibility Study alternatives with respect to the Bayer Corporation.
 - Conducted telephone interviews with representatives from Harcros Chemical, Inc., Sinclair Oil, BNSF Railroad, and Bayer Corporation.
 - Reviewed the following aerial photograph:

1993 Flood photos for Argentine, NKC, and East Bottoms Levees Harlem section of NKC Levee - 1958, 1965, 1976 and 1986 Argentine Levee - 1951, 1954, 1970, and 1983

- Reviewed Corps of Engineers correspondence files for each of the Phase I levee units. The files included correspondence from adjacent landowners on work performed within 500 feet of the levee centerline.
- Conducted site visits to the following locations:

Argentine Levee

Burlington Northern Santa Fe Railroad property

BPU Property on the Fairfax-Jersey Creek Levee

Harlem Section of the North Kansas City (NKC) Levee

Bayer Corporation Property on the East Bottoms Levee

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The Argentine Levee has five known sites adjacent to the levee under Resource Conservation and Recovery Act (RCRA) Corrective Action or voluntary cleanup. The Fairfax/Jersey Creek Levee lies to the north of the Board of Public Utilities, which has had past spills into the Missouri River downstream of the proposed levee floodwall. National Starch is protected by the North Kansas City Levee and is a RCRA permitted facility. The East Bottoms Levee wraps around the Bayer Facility, which is undergoing RCRA Corrective Action.

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3.1.7.1 Argentine Levee Unit

The Argentine Levee Unit protects a heavily industrialized zone of Kansas City, Kansas. The following properties have been identified as undergoing either RCRA Corrective Action or Voluntary Clean up.

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- Ashland Chemical RCRA Corrective Action
- Harcros Chemical RCRA Corrective Action
- Sinclair Oil Corporation Voluntary Cleanup
- Fairbanks Morse Corporation Voluntary Cleanup
- Burlington Northern Santa Fe Railroad Voluntary Cleanup

Ashland Chemical operates a chemical storage facility. It currently has an air-stripper on site to remediate groundwater contamination originating from the property. Underground storage tanks have been removed from the site.

Harcros Chemical, formerly Thompson-Hayward Chemical Corporation, also has known groundwater contamination. The company operates a chemical plant that produces a wide variety of chemicals. The property is currently in the Corrective Measures Study phase. A groundwater extraction and treatment system is in place on site to capture and remediate groundwater plumes migrating from the site to the Kansas River. Nine solid waste management units (SWMUs) lie on both sides of the levee. Two underground storage tanks are listed in the Kansas Department of Health and the Environment Leaking Underground Storage Tank database as active status. These have not been remediated at the last update of the Leaking Underground Storage Tank database, which occurred December 5, 2005.

Sinclair Oil Corporation is a former oil refinery that currently operates a petroleum storage facility. This site has a network of groundwater monitoring wells that are located within the levee construction footprint. The most recent sampling has detected volatile organic compounds (VOCs), halogenated VOCs, semi-volatile organic compounds (SVOCs), pesticides, and herbicides in the groundwater. VOCs were detected above maximum contaminant limits (MCLs) in the groundwater wells near the Kansas River. Boring logs for the temporary piezometers installed in August of 2003, noted petroleum at various depths. They were drilled near the edge of the plumes to define the extent of the contamination. The depths to groundwater ranged from 11.5 feet to approximately 40 feet below ground surface. The facility plans to install a groundwater containment system to intercept the plumes.

Fairbanks Morse Pump Corporation lies outside of the construction footprint for the levee but also had groundwater contamination extending from its facility to the Kansas River. Fairbanks Morse manufactures pumps and small motors for public works and industrial installations. These plumes are traveling to the northeast extending to just east of the Overnite Trucking facility. The plumes are primarily chlorinated VOCs and petroleum related VOCs. The company is permitted by the USEPA as a RCRA small quantity generator and has had numerous compliance violations. According to the Toxic Release Inventory System database, chromium, nickel, copper, and manganese have been released from the facility. A Leaking Underground Storage Tank is also listed for this site, and it is currently being monitored by KDHE. No corrective action has been initiated for the Leaking Underground Storage Tank or the groundwater plumes.

The Burlington Northern Santa Fe (BNSF) Railroad has a diesel shop facility for refueling and repairing engines. This facility is a RCRA-permitted large quantity generator with numerous compliance violations. A diesel spill was reported in June of 1997 and was remediated. The investigation by BNSF of this site is ongoing. Past borings have shown the presence of hydrocarbons in the soil ranging from an odor to the soil to a "pudding-like" contaminant visible in the sample. Waste has also been buried in scattered areas near the facility's water treatment tanks. Groundwater is also impacted by petroleum hydrocarbons. Geoprobe borings were drilled around a 9' by 9' stormwater culvert. During this investigation, total petroleum hydrocarbons and benzene were detected above KDHE action levels for soil. Other chemicals detected included barium, lead, arsenic, and fluorene. Currently, there is an oil-water separator on site to treat all waste and stormwater before it is discharged into the river or sewer system.

Other sites adjacent to the Argentine Levee Unit may have been impacted by past industrial activities. These sites were identified from site visits along the levee or from historical aerial photos and include:

- Auto Salvage Yards
- E&M Transwood Truck and Trailer Repair
- Roadway Express

The Auto salvage yards are located on the landward side of the levee and include an abandoned building. This building has the appearance of an auto body shop or a service station. No information could be found for this structure. Therefore, an underground storage tank could be present. As determined from aerial photographs, the auto salvage yards extend towards Kansas Avenue on the landward side of the levee, and downriver to the BNSF Railroad. The vehicles sit out in the elements and could leak any fluids still left in the engine or gas tank.

E & M Transwood Truck and Trailer Repair is a service center for large vehicles and trailers. This site has a history of spills from leaking underground tanks. These have been remediated and closed by KDHE. During a site visit, however, a gas or diesel pump station was located behind the service shop. An underground tank remains in active use. If damage occurred to the tank or the pipework, hydrocarbons could leak into the subsurface soil and groundwater.

Roadway Express is a trailer storage yard and service center for semi-trucks and trailers. This facility has had numerous spills in a 10-year period. A leaking underground storage tank was also remediated. Five other underground storage tanks remain on the site and are actively used. However, the underground storage tank locations are unknown.

3.1.7.2 Fairfax-Jersey Creek Levee Unit

The Board of Public Utilities operates a power plant just south of the Fairfax Levee. The main area of operations is over 100 feet from the floodwall construction footprint. Numerous spills have occurred in this area from the transformer, turbines, and valves on other equipment. Some of these spills flowed into a stormwater sewer and reached the Kansas River. Two Leaking Underground Storage Tanks were removed and soils were remediated in 1989 and 1993. The Board of Public Utilities is permitted as a small quantity generator and was issued violation notices in 1987 and 1994. The Williams Company has three petroleum pipelines that run parallel to the existing floodwall on the riverward side. No spills have occurred from these pipelines.

3.1.7.3 North Kansas City Levee Unit

The National Starch Company is located just north of the North Kansas City Levee. The facility produces cornstarch for distribution. The facility has a National Pollutant Discharge Elimination System (NPDES) permit to discharge wet corn milling, condensation flows, noncontact cooling water, and stormwater runoff into the Missouri River and has a flow of 8 million gallons/day. From the USEPA website, National Starch was listed in the TRIS, Aerometric Information Retrieval System (AIRS), and Underground Storage Tank databases. National Starch has had a past air release of propylene oxide from one of its stacks. It is listed in AIRS and is permitted to release 100 tons/year of cornstarch. National Starch is also permitted as a RCRA Large Quantity Generator. The property has one 30,000 gallon Underground Storage Tank that is currently in use. A past geotechnical investigation around the site noted a petroleum odor in a soil boring from a depth of 9' to 25.5' below ground surface. This was found in a

containment area a few hundred feet from the levee, but no tank was present at the site. None of the borings conducted closer to the river showed any type of contamination.

3.1.7.4 East Bottoms Levee Unit

The Bayer Crop Science facility manufactures various insecticides, herbicides, and fungicides for agricultural purposes. Since late 1980, numerous investigations have been conducted at the site. Investigations include a RCRA Facility Assessment, a RCRA Facility Investigation (RFI) and a Corrective Measures Study (CMS) Work Plan. Based on the information presented in these documents, there is known soil and groundwater contamination present at the site. Three SWMUs and three Areas of Concern (AOC) have been identified at the Bayer facility. The SWMUs are former land disposal units, which have been capped with soil. The contaminants found in the soil at the SWMUs are primarily VOCs, SVOCs and pesticides. AOC-1 is located in the southern portion of the drainage ditch. Relatively low levels of SVOCs and pesticides were detected in the shallow soil along the bottom of the ditch. AOC-3 and AOC-4 are potentially impacted by historical releases of wastewater. Sampling results from these areas were not available. Since the CMS has not been developed, there is no recommended corrective action planned for the contaminated soils at this time.

There are two known groundwater plumes at the Bayer facility. Both of these plumes are associated with the former land disposal units. The primary constituents detected in the groundwater are VOCs, SVOCs and pesticides. The VOCs include benzene, toluene, xylenes, and chlorinated solvents. There are a total of 30 groundwater monitoring wells and three extraction wells at the Bayer site. As an interim measure for groundwater containment, Bayer pumps from the two plume areas to recover impacted groundwater and stabilize groundwater migration. The extracted groundwater is treated at the on-site wastewater treatment facility and discharged to the Missouri River through an underground piping and permitted NPDES outfall. The final corrective measures for the groundwater cleanup have not been developed.

A groundwater investigation was done by USACE to determine if any chemicals would impact preferred alternative along the stretch of levee adjacent to the Blue River. The analysis showed only manganese was present above the secondary MCLs in the groundwater. USACE results for manganese were similar to previous Bayer groundwater sampling rounds. Since manganese is not a contaminant of concern at Bayer, this will also not impact the relief wells proposed for the Kansas City Levees project.

3.1.7.5 Proposed Borrow Area

The area of proposed borrow is currently owned by WaterOne, which provides drinking water to Johnson County, Kansas. A portion of the property is leased for agricultural purposes. Lime products are stockpiled in 5-acre monofills in the southern portion of the property. The monofills extend to 20 feet deep and are covered with a 10-foot thick soil cap. There are no known hazardous waste issues with the lime product. Soil samples from the proposed borrow area were analyzed for VOCs, metals, pesticides, herbicides, and SVOCs. All parameters tested were below action levels. No contamination was found at the other locations during the soil sampling investigation. Therefore, soils on this property are suitable to use as borrow material for levee modifications. Monofills would not be used for soil borrowing purposes.

3.1.8 Cultural Resources

Cultural resources are defined as the broad pattern of events, real properties, and cultural life ways or practices that have significance to humans. Buildings and places where significant events occurred, archeological sites containing significant information about human activities,

traditional places or activities that hold special significance, and folkways which are practiced as either cultural or life sustaining, are all part of the broad category features of groups of people.

3.1.8.1 Archeological and Historical Background

The earliest identified human occupation in the vicinity of the study area in eastern Kansas and western Missouri is the Paleo-Indian period dating from approximately 12,000 to 8,000 B.C. Evidence of these sites in the vicinity of the study area is scarce and consists of only a few isolated projectile point finds. It is likely that additional Paleo-Indian sites are present within the Kansas and Missouri River area. However, these sites are likely deeply buried.

The Archaic period is divided into the Early, Middle, and Late periods. The Early Archaic period (8,000 to 5,000 B.C.) is characterized as a period of increased subsistence diversification following mega fauna extinction at the end of the Pleistocene. Like the Paleo-Indian period, evidence of these sites within the Blue River area is sparse and usually consists of isolated projectile points. Additional Early Archaic sites are likely also present but like possible Paleo-Indian sites, they are deeply buried in the Kansas and Missouri River drainages in the Kansas City area. The Middle Archaic period (5,000 to 3,000 B.C.) is a period of increasing diversification of exploited plant and animal resources and ecological niches. These sites are generally small, but are more numerous in the study area than sites from earlier periods. The Late Archaic (3,000-1,000 B.C) is marked by increased social complexity and further diversification. These sites are typically larger and more numerous than the preceding periods. The distinctive Nebo Hill site types appear during the Late Archaic.

The Early and Middle Woodland periods (1,000 B.C.- A.D. 500) are characterized by larger and more numerous sites, long distance trade, and reliance on cultivated plants. In addition, the use of ceramics, creation of burial mounds, and ornate ceremonial objects were developed during this time period. The Middle Woodland (ca. A.D. 1-500) also saw the development of the Kansas City Hopewell, a large distinctive cultural complex that was centered in the area of present day Kansas City. Sites of this period are commonly found in and along the Kansas and Missouri River drainages in the Kansas City area and include large village sites and small short-term specialty sites. The Late Woodland (A.D. 500-1000) is marked by increased reliance on hunting and gathering of wild plants and animals, smaller site size, and increased mobility. The reason for the shift to increased mobility and reliance on hunting and gathering is unclear but may be related to an over stressed environment. Late Woodland sites are smaller than the sites of the previous Middle Woodland period but are common throughout the study area.

 The Mississippian period (A.D.1000 to 1700) is marked by the emergence, development, and fall of complex societies and large ceremonial centers, such as Cahokia near present day St. Louis. Sites of Mississippian period have been identified near the study area. A number of these sites have been intensively investigated, including the May Brook Site (23JA43), Seven Acres site (41JA115), and the Vaughn-Estess Site (23JA269).

The historical period within the study area begins at the point of European contact, roughly in 1700. At the time of contact, the eastern study area was the approximate border of the Kansa tribe situated to the west and the Osage located to the east and southeast. At the time, the Kansas City area was mainly Osage hunting territory and was only lightly occupied. Spain and France had control of the region during the 18th Century, during which time the area was utilized primarily for trade with the tribes and fur trapping.

In 1803, the United States obtained the land in the study area from France as part of the Louisiana Purchase. Following the purchase, numerous explorers passed through the region, the

most notable being the Lewis and Clark Corps of Discovery expedition of 1804-1806 that passed along the Missouri River near the beginning and end of their journey. In 1808, Fort Osage was established near the confluence of the Little Blue and Missouri Rivers by William Clark to protect the new territory and nearby US Factory Trade House, which was operated by George Sibley. Other trading posts were located within the study area. The most prominent trading post was established by Francois Chouteau in 1821, west of the confluence of the Missouri and Blue Rivers.

By the mid-1820's, the Osage (1808) and the Kansa (1825) had ceded their territory in the region to the United States. A number of eastern tribes, including the Shawnee, Delaware, Wyandots, Miami, Ottawa, Kickapoo, Potawatomi, Iowa, Sac and Fox, Wea, and Peoria, passed through the study area after having been forced westward from their traditional homelands. Several missions were created for these tribes near the study area.

A number of important trails serving commercial trade and westward migrations crossed the area. The most prominent of these trails, the Santa Fe Trail, began in 1821 as a route of trade between Santa Fe, then Mexico, and the United States. The trail remained an important economic link for the next 60 years until it became obsolete following establishment of the railroad in the area. Other important trails in the area include the Oregon and California Trails. Through much of the area these trails overlapped, diverging to their respective routes farther to the west.

Numerous battles and skirmishes occurred within the Kansas City area during the Civil War. Many of these engagements were small-scale battles or guerrilla actions. The largest battle in the area, also the largest fought west of the Mississippi River, were the Battles of the Big Blue and Westport, Missouri on October 22 and 23, 1864. This series of battles occurred as the result of an attempt by the South, under the command of General Sterling Price, to capture Kansas City or Leavenworth, Kansas, for the Confederacy to divert northern troops from other theaters in the war. The campaign ultimately failed and the defeat proved to be the last major battle of the war in Missouri.

In the late 19th and early 20th Century land use in the area shifted from an agricultural, residential, and light commercial base to increasingly industrial. Also, the Kansas City Stockyards developed in the West Bottoms area of Kansas City as a major cattle export center to Chicago and destinations east. The second half of the 20th Century saw increased industrial development.

3.1.8.2 Previous Investigations

A review of the National Register of Historic Places found no historic properties listed within or near the study area. In addition, a review of topographic site location maps from the Kansas and Missouri State Historic Preservation Officers found no previously recorded archeological sites or historical structures within or immediately adjacent to the proposed study area.

Adjacent to the Fairfax floodwall project area are two remaining structures of the former Quindaro water processing plant—a pump house and a water intake structure. Both structures are approximately 100 years old.

Adjacent to the proposed borrow area are two human burials that will be provided a construction buffer of 300 feet to avoid impacting the burials.

3.1.8.3 Cultural Resource Coordination

Numerous cultural resource investigations have been conducted within the vicinity of the study area. The majority of the past investigations have been relatively small-scale archeological investigations, primarily surveys, associated with federal or federally funded projects. Other projects include archeological National Register testing projects, data recovery excavations, and monitoring of archeological work at known cultural resource locations.

During site visits, the Corp's Kansas City District Cultural Resources Program Manager (CRPM) identified no historic properties or other cultural resources in any of the six proposed project locations. In addition, each area was found to have little likelihood for intact archeological deposits because of previous disturbances. The CRPM recommended no further work for any of the proposed areas and the SHPOs concurred (Appendix G).

The former pump house within the vicinity of the Fairfax floodwall was within a former alternative area for the project. However, project plans have been modified to avoid the pump house. Although the structure itself is outside of the area of potential effect, the project will require that the subterranean pump room in the pump house be filled with sand to prevent seepage. The water intake structure was never within the proposed project limits and will remain undisturbed.

The Corps has initiated consultation with affiliated federally recognized Native American tribes. Additional consultation would be conducted for any archeological site, traditional cultural property, or other historical property accidentally discovered in the project areas during construction.

If, in the unlikely event that archeological sites are encountered during construction, work in the area of the inadvertent discovery would cease and the Corps project manager notified. The discovery would be coordinated with SHPOs and appropriate treatment measures applied.

3.2 Biological Environment

The Kansas Citys' project area is heavily urbanized and industrialized. U.S. Fish and Wildlife Service comments and the Corps' draft response are in Appendix C of this DEIS.

3.2.1 Floodplain Terrestrial Habitat

The study area is located primarily within the Glaciated Plains and Big Rivers natural divisions (Nelson, 1987). Prior to channelization and development, meandering rivers formed complex ecosystems that contained a variety of natural communities such as marshes, sloughs, islands, sandbars, and bottomland forests. Bottomland forest occupied extensive floodplains of the Missouri and Kansas Rivers. Floodplains were dominated by a variety of tree species including eastern cottonwood (*Populus detoides*), silver maple (*Acer saccharinum*), willow (*Salix*), hackberry (*Celtis occidentalis*), ash (*Fraxinus*), elm (*Ulmus*) and river birch (*Betula nigra*). Mixed hardwood forests with a dominating oak (*Quercus*) component were generally associated with higher, adequately drained, and less disturbed terraces (Nigh and Schroeder, 2002). Bottomland hardwood tree species included swamp white oak (*Q. bicolor*), bur oak (*Q. macrocarpa*), pin oak (*Q. palustris*), American elm (*Ulmus americana*), and big shellbark hickory (*Carya laciniosa*).

The floodplain at the confluence of the Missouri and Kansas Rivers contains only remnants of the bottomland forests likely present in the project area in pre-settlement times. Three vegetation types generally dominated the project area. Floodplain forests were dominated

by cottonwood-willow (*Populus-Salix*). Upland vegetation included oak-hickory-maple forest (*Quercus-Carya-Acer*), with openings of bluestem prairie (*Andropogon-Panicum-Sorghastrum*).

Although the project area's floodplains have been largely cleared for development, there are bands of riparian forest habitat located riverward of some of the Kansas Citys' units. The largest areas of native vegetation are located riverward of the Birmingham and East Bottoms Levee Units in Missouri and the Argentine and Fairfax-Jersey Creek Levee Units in Kansas. Predominant tree species found in these riparian bands include cottonwood, willows, box elder (*Acer negundo*), green ash (*Fraxinus pennsylvanica*), silver maple, and American sycamore (*Platanus occidentalis*). The understory primarily includes reproduction of these species, plus some red mulberry (*Morus rubra*). The ground layer in the riparian bands varies from sparse to dense vegetation and primarily contains poison ivy (*Toxicodencron radicans*), Virginia creeper (*Parthenocissus quinquefolia*), honeysuckle (*Lonicera* spp.), and greenbrier (Smilax), among others (USFWS Planning Aid Letter (PAL), July 1999.)

Remnants of the "oak-hickory-maple" upland forest vegetation type are present on the steep hillsides adjacent to the Kansas and Missouri River floodplains. In addition to sugar maple, white and black oak, and hickories for which this upland vegetation type is named, other hardwood species present include American sycamore, beech (*Carpinus caroliniana*), black walnut (*Juglans nigra*), bur and chinkapin oak (*Quercus muehlenbergii*), hackberry, American and slippery elm (*Ulmus americana* and *Ulmus rubra*), hawthorn (*Cretageus*), honey locust (*Gleditsia triacanthos*), redbud (*Cercis canadensis*), and dogwood (*Cornus*). The understory consists of regeneration of the above species and the ground layer includes, among others, violets (*Viola* spp.), poison ivy, Virginia creeper, greenbrier, and honeysuckle.

3.2.2 Wetlands

Wetland locations, classifications, and acreages were determined by overlaying study area maps with National Wetlands Inventory (NWI) maps. NWI maps are generally used as a reference for locating existing wetlands. Reconnaissance surveys and a field delineation were conducted to verify the presence or absence of NWI wetlands and additional wetlands located within or adjacent to the project area for impact determination. Due to development within the project area, much wetland acreage has been converted into impervious surface.

There are four wetlands within the project area that are located within, or adjacent to areas proposed for construction. Three wetlands are located within the Argentine unit, and one wetland is located within the proposed borrow area. An open water/scrub-shrub/emergent wetland of unknown acreage is located between stations +/- 110+00 to 120+00 on Harcros Chemicals property. This wetland was likely created for detention, as it is bermed to the west, and bordered by a fence. Monitoring wells are located within the western and southern portion of the wetland. Due to its location within the landscape adjacent to industry and the adjacent fenceline, the functions provided by this wetland may include surface water storage and limited wildlife habitat.

A 0.007-acre linear, emergent wetland dominated by cattails (*Typha* sp.) and curly dock (*Rumex crispus*) is located in a maintained area between the fenceline and the levee toe, station 140+00. A 0.02-acre linear emergent wetland dominated by reed canarygrass (*Phalaris arundinaceae*) and cattails (*Typha* sp.) is located along the fenceline at station 155+00. These wetlands are not visible from the river. A 0.17-acre farmed wetland located within the proposed borrow area was identified by the USFWS in their DCAR (USFWS, 2005). The area of proposed borrow has not been delineated for potential wetlands by the NRCS. The functions of these wetlands consist of limited wildlife habitat.

3.2.3 Fisheries

 Missouri River fish populations have been significantly effected by channel alterations in the project area. Kansas River populations have also been impacted, although to a lesser degree. Most indigenous fish species still remain, but have suffered serious population declines. Both rivers' fisheries are characterized by species typical of large, turbid rivers. The USFWS Draft PAL (1999) describes the dominant game fish species: smallmouth buffalo (*Ictiobus bubalus*), common carp (*Cyprinus carpio*), river carpsucker (*Carpiodes carpio*), shortnose gar (*Lepisosteus platostomus*), and channel catfish (*Ictalurus punctatus*). Gizzard shad (*Dorsoma cepadianum*) is the dominant forage species. Other game species present are the flathead and blue catfish (*Pylodictis olivaris* and *Ictalurus furcatus*), white crappie (*Pomoxis annularis*), freshwater drum (*Aplodinotus grunniens*), longnose gar (*Lepisosteus osseus*), green sunfish (*Lepomis cyanellus*), and bluegill (*Lepomis macrochirus*). Other forage and nongame species present include various minnows and shiners.

3.2.4 Wildlife

The avifauna of the study area includes permanent residents, summer residents, transients, and winter residents. The USFWS (1999) stated that the project area provides year-around habitat for approximately 31 bird species, with another 67 species using the project area for nesting and another 14 species as winter residents only. Over 110 species use the corridor over the study area for fall migration. Summer resident species associated with aquatic habitats include waterfowl, wading birds, and selected passerines. Summer waterfowl are dominated by wood ducks which nest in wooded bottomlands and rear their young in nearby aquatic habitats. Nesting by other waterfowl, primarily mallards, is minor. Wading birds, such as the great blue heron and green heron, utilize shallow areas as foraging habitat. Waterfowl and shorebirds dominate transient species associated with aquatic habitats. The most numerous and impressive migration is that of the snow goose, particularly in the spring. Other species present during migration include the Canada goose, mallard, and pintail.

Mammals associated with the remaining wooded riparian habitat include the white-tailed deer, eastern cottontails, and red and gray squirrels. Aquatic and terrestrial furbearers are important parts of the ecosystem, and those present in the area include the beaver, mink, and muskrat (dependent on the aquatic habitat) and opossum, coyote, raccoon, and striped skunk (dependent on terrestrial habitat). However, small mammals, such as mice, voles, rats, and bats account for the majority of the species present. The white-tailed deer is the only naturally occurring large mammal still common in developed urban areas. Eastern wild turkeys are present in the open, less developed floodplain areas (e.g., the Birmingham and East Bottoms Levee Units).

Amphibians that may be present within the study area include the tiger salamander, bullfrog, leopard frog, plains toad, northern cricket frog, striped chorus frog, plains spadefoot toad, western chorus frog, and plains leopard frog.

Reptiles that may be found in the study area include the snapping turtle, ornate box turtle, painted turtle, rough-scaled lizard, prairie skink, Great Plains skink, six-lined racerunner, and glass-snake lizard. The black rat snake, prairie ringneck snake, eastern hognose snake, racer, bullsnake, prairie kingsnake, common watersnake, red-sided garter snake, copperhead, and timber rattlesnake may also occur within the project area.

3.2.5 Threatened and Endangered Species

Four Federally-listed threatened or endangered species were reported by the USFWS as dependent on the Missouri and Kansas Rivers and their floodplains within the study area: the threatened bald eagle (*Haliaeetus leucocephalus*), threatened piping plover (*Charadrius melodus*), endangered least tern (*Sterna antillarum*) and endangered pallid sturgeon (*Scaphirhynchus albus*) (USFWS, 1999). The piping plover is the only species with designated critical habitat. However, none of its critical habitat is located within, or adjacent to the study area (50 CFR 17).

In 2000, the USFWS issued the "Missouri River Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System" (BiOp). The BiOp included jeopardy findings for the plover, tern, and pallid sturgeon and recommended a series of "Reasonable and Prudent Alternative, Reasonable and Prudent Measures to Minimize Take" and "Conservation Recommendations." They included recommended actions for the interior least tern, piping plover, pallid sturgeon and the ecosystem in general that the USFWS believed will avoid jeopardizing the continued existence of the three species.

Bald Eagle

The bald eagle migrates through and temporarily over-winters near large water bodies in or near the study area. According to the PAL (1999), this species can be found within the study area primarily during fall and winter when migrating birds utilize areas along the Missouri, Kansas, and Big Blue Rivers for feeding and resting. The Kansas River has nesting pairs of bald eagles, with parents and young remaining in the area through the spring and summer months. Trees greater than 12 inches in diameter at breast height adjacent to these waterways are used by bald eagles for night roosts, resting and hunting perches. No critical habitat has been designated for the bald eagle. The bald eagle is currently proposed for de-listing under the Endangered Species Act. Although de-listing is a possibility, the bald eagle is still protected under several Federal laws.

Piping Plover

The piping plover is a seasonal spring and fall migrant through portions of Kansas and Missouri along the Kansas and Missouri Rivers, with nesting on the Kansas. Plovers are associated with unvegetated shorelines, sandbars, and mudflats. The first known breeding record for the piping plover on the Kansas River occurred in 1996 when two pairs of plovers nested on sandbar habitat. This habitat was on a new channel created by the high water in 1993. The new nesting in Kansas on the Kansas River is a southern extension of their breeding range.

Interior Least Tern

The interior least tern utilizes similar habitat as piping plovers in the same geographic regions of Kansas and Missouri. There are no records of least terns nesting on the mainstem Kansas River before 1996 when they were observed near river mile 131.0. Since then, colonies or individual pairs have continued nesting each year in the middle sections of the river (approximately river mile 65.0 to 140.0, most frequently from approximately river mile 75.0 to 130.0). Birds have relocated and used different sandbars throughout this time period in response to continued revegetation of sandbar habitats. Nesting interior least tern populations on the Kansas River have remained small (8-10). No critical habitat has been designated for the interior least tern.

Piping Plover and Interior Least Tern Nesting Sites

There are no known nesting sites for either the piping plover or least tern within the study area. On the Kansas River the closest documented nesting site was located between Lawrence and Topeka, Kansas greater than 10 miles upriver from the project area. However, that site has been inactive for several years. Current active nest sites on the Kansas are located near Wamego, Kansas in Pottawatomie County. On the Missouri River, the nearest active nest sites are located near Ponca State Park in northeastern Nebraska.

Pallid Sturgeon

The pallid sturgeon is a moderately large, bottom-dwelling (benthic) fish species that may occur in low numbers in portions of the Missouri River and Kansas River. There are no records to indicate that pallid sturgeon have ever occurred in the Blue River (Dryer and Sandvol, 1993). Pallid sturgeons inhabit the mainstem Missouri River, and have entered the lower Kansas River during floods. Since the 1950s, only five documented pallid sturgeon have been sampled from the lower 40 miles of the Kansas River, all during late March and early April of 1952. Due to habitat modifications and physical barrier (e.g. Johnson County Weir), it is unlikely that the pallid sturgeon currently occurs in the Kansas River due to habitat modifications and physical barriers (e.g. Johnson County Weir), except during high flows. It is believed that the pallid requires sandbars, chutes, and backwater areas for reproduction. Due to its migratory nature, the pallid sturgeon may occasionally be present within the rivers adjacent to the proposed construction areas. There is no designated critical habitat for the pallid sturgeon.

State Listed Species

In addition to the federally listed threatened and endangered species listed above, Kansas and Missouri maintain state lists of species of conservation concern. State of Kansas threatened and endangered species listed for Wyandotte County are in Appendix D. The State of Missouri no longer uses the 'threatened' designation. Missouri species are either designated as "State Endangered", and/or assigned a state rank, which denotes the level of concern for each species' continued existence in Missouri.

A numeric rank of S1 through S5 is assigned to species based upon their relative endangerment (Missouri Natural Heritage Program, 2005). Natural Heritage Database results for Jackson and Clay Counties are listed in Appendix D.

3.3 Socio-Economic Environment

The Kansas City metropolitan area has a diverse and varied economic base. As a centrally located market, it is a major warehouse and distribution hub, and a leading agribusiness center. It ranks first in the nation as a farm distribution center and as a market for hard wheat. In addition to its agribusiness activities, the metropolitan area has major industrial activities such as auto and truck assembly, steel and metal fabrication, and food processing. The metropolitan area also fosters a growing non-manufacturing sector. Wholesale and retail industries and service organizations are now chief employers in the area. The socioeconomic characteristics of the project area are described by levee unit below.

The metropolitan area has a major network of interstates and major highways that provides excellent access to each of the levee units. The CID Unit is accessed by means of Interstate 70 on the north, by Interstate 35 on the West, and by Interstate 670, which crosses the center portion of the protected area. U.S. Highway 69 and Interstate 35 provide access to the Argentine Unit, and U.S. 69, U.S. 169, and Interstate 70 serve the Armourdale Unit. Interstate 70 and the Fairfax Bridge/U.S. 69 provide major highway access to the Fairfax-Jersey Creek Unit. Missouri Highway 210, Burlington Avenue, the Paseo and Heart of America Bridges, and

Interstates 35 and 435 provide access to the North Kansas City Unit. The East Bottoms Unit is served by Interstates 29, 35, and 435, and the Birmingham Unit has ready access by means of Missouri Highway 210 and Interstates 29, 35 and 435. Kansas City International Airport, less than 20 miles north of the study area, is easily accessible via the interstate system and major rail service is available to each of the units, and the Charles B. Wheeler (Downtown) Airport is located in the North Kansas City Unit. The Greater Kansas City Area is generally considered to be the nation's second largest rail center, second only to Chicago, IL. The trunk lines serving Kansas City have main line tracks in the areas protected by the Kansas City Levees. Greater Kansas City is also among the top five trucking centers in the nation.

Census 2000 data for 17 census tracts were compiled to describe the socioeconomic characteristics of each levee unit area as well as for the overall study area. Census 2000 data were also compiled for counties in the study area and for the Kansas City, Missouri and Kansas Metropolitan Statistical Area (KC MSA). Although census tracts cover areas that may typically be somewhat larger than the area protected by a levee unit, census tract data are considered to be generally representative of the protected area data and characteristics.

3.3.1 Argentine Unit

Land Use and Location

The Argentine Unit is located on the right bank of the Kansas River in Wyandotte County, Kansas. The unit protects the Argentine industrial district in the Kansas City, Kansas metropolitan area that includes major industrial and commercial development. The Argentine rail yard, one of the busiest in the nation, is located in this unit. A residential area is also protected. Census tracts 428 and 438.04 approximate the area protected by the Argentine Unit. These census tracts cover about 4.1 square miles of land area.

Population, Income and Employment Characteristics

The Argentine Unit census tracts had a resident population of nearly 3,481 persons in the year 2000, a decline of about 2.5% from the population living in the area in 1990. The median age ranges from 28.3 to 35.0, and the percent of population 65 years of age and over is about 13.2 percent as compared with 11.4 percent for the KC MSA. Approximately 34 percent of the Argentine population is under the age of 18 years. Median household income in 1999 was not available for one census tract. The other census tract had a median household income of \$24,740, compared with \$33,784 for Wyandotte County and \$46,193 for the KC MSA. Approximately 26.4 percent of the Argentine population lives below poverty level, higher than for the KC MSA (8.5%) and Wyandotte County (16.5%). There were 10,700 people working in the Argentine industrial area in 2000 representing a growth of 7.4% in employment over the 1990 level of 9,960. Employment is expected to continue to increase over the next decade in the Argentine Unit area.

Housing Characteristics

There are 3,481 housing units in the census tracts that cover the Argentine Unit. These units have a vacancy rate of 7.1 percent, higher than the 6.3 percent rate for the KC MSA, and lower than the 9.4 percent vacancy rate for Wyandotte County. The median value of owner occupied housing units was not available for one census tract and was \$67,600 for the other census tract, compared with \$54,300 for Wyandotte County and \$104,700 for the KC MSA. A lower percentage of housing units were built before 1940 in the Argentine Unit (7.2%) compared with housing units in the KC MSA (12.9%) and in Wyandotte County (18.8%).

1954 3.3.2 Armourdale Unit

1956 Land Use and Location

The Armourdale Unit is located on the left bank of the Kansas River in Wyandotte County, Kansas. This unit protects the Armourdale area of the City of Kansas City, Kansas. Facilities of the Kansas City, Kansas Board of Public Utilities are located in this study area as well as major railroad yards and main line tracks. Census tracts 425.01, 425.02, and 426, with a land area of 3.8 square miles, cover the area protected by the Armourdale Unit.

Population, Income and Employment Characteristics

Population in the Armourdale Unit decreased from 3,478 in 1990 to 3,213 in 2000 (7.6 % decrease). The median age for residents in the census tracts in the Armourdale Unit ranges from 27.6 years to 77.0 years. In comparison, the median age for the KC MSA is 35.2 years and 32.5 years for Wyandotte County. Approximately 7.9 % of the population is over 65 years old. This is lower than the 65 years and older percentage for the KC MSA and for Wyandotte County (11.4 % and 11.7 % respectively). Approximately 33.2 % of the total population in the Armourdale Unit is in the under 18 years of age category, compared with 26.6 % for the KC MSA, and 28.5 % for Wyandotte County. Median household income in the Armourdale Unit census tracts ranges from \$27,524 to \$102,264. Median household incomes for Wyandotte County and the KC MSA are \$33,784 and \$46,193, respectively. A higher percentage of the Armourdale Unit population is below poverty level (35.2 %) compared with 8.5 % in the KC MSA and 16.5 % in Wyandotte County.

About 6,700 people work in the Armourdale area (2000 estimates), an increase of 1.6% over the 1990 employment level. The resident labor force in Armourdale is primarily employed in production/transportation and service occupations.

Housing Characteristics

The 1,109 housing units in the Armourdale Unit had a vacancy rate of 11.1 %, higher than the 9.4 % vacancy rate for Wyandotte County and the 6.3 % rate for the KC MSA. The median value of owner occupied housing units ranged from \$22,600 to \$162,500 compared with a median value of \$54,300 for Wyandotte County and \$104,700 for the KC MSA. More than 32 % of the housing units in the Armourdale Levee Unit were built before 1940 compared with 18.8 % for Wyandotte County and 12.9 % for the KC MSA.

3.3.3 Fairfax-Jersey Creek Unit

Land Use and Location

The Fairfax-Jersey Creek Unit is located on the right bank of the Missouri River in
Wyandotte County, Kansas. This unit protects the Fairfax Industrial District in the Kansas City,
Kansas metropolitan area. Census tract 400.01 approximates the area protected by the FairfaxJersey Creek Unit and covers about 3.8 square miles.

Population, Income and Employment Characteristics

Few or no persons currently live in the Fairfax industrial area. There were 11,180 people working in this industrial area in 2000 representing an increase of 6.5 % over the 1990 employment in this area. Employment in this levee unit is expected to remain fairly stable over the near term.

Housing Characteristics

No housing data was provided for census tracts in this levee unit area in the 2000 census.

3.3.4 Central Industrial District Unit, Missouri and Kansas

Land Use and Location

The Central Industrial District Unit (CID) is located on the right banks of the Missouri and Kansas Rivers near their confluence. The protected area lies on both sides of the state line between Missouri and Kansas, and includes the central industrial districts of both the City of Kansas City, Missouri and the City of Kansas City, Kansas. The protected area encompasses census tracts 1, 2 and 400.02. These tracts have a land area of 1.8 square miles. Kemper Arena, the American Royal Building, and world headquarters for a major manufacturing company are located in this protected area.

Population, Income and Employment Characteristics

In 2000, the CID had a population of 936 representing a very significant increase (1027.7%) over the 1990 population of 83 persons. This population increase appears to be primarily a result of a popular trend of developing industrial warehouses and commercial buildings in this area for residential use. The CID is currently one of several "loft-living" areas being developed in the Kansas City metropolitan area. Population is expected to continue to increase in the CID area as a result of this trend.

The CID census tracts median age ranges from 29.5 to 32.4, compared with the KC MSA median age of 35.2. The lower median ages for these census tracts may be attributable to the fact that the CID attracts young professionals interested in loft-style living. Residents under the age of 18 years comprise about 1.7 % of total population in the CID, compared with 26.6 % for the KC MSA, 28.5 % for Wyandotte County, and 25.8 % for Jackson County. The CID % of population age 65 and over was only 0.8 % of total population, significantly lower than Wyandotte County (11.7%), Jackson County (12.5%), and the KC MSA (11.4%). Median household income in the census tracts in the CID (1999 dollars) ranged from \$34,464 to \$36,625. The CID median incomes were lower than the median income for Jackson County Missouri (\$39,277) and the Kansas City metropolitan area (\$46,193), but higher than for Wyandotte County Kansas (\$33,784). The CID had a lower percentage of the population living below poverty level (9.3%) compared with 11.9 % and 16.5 % for Jackson and Wyandotte Counties respectively. However, the CID percentage was slightly above the 8.5 % for the KC MSA.

In the year 2000, there were 7,494 persons working in the CID, representing a 12 % decline from an employment level of 8,516 in 1990. An increase in employment in the CID would be expected with the increasing resident population and the accompanying small commercial businesses that are required to support the growing resident population. Current ongoing and planned near-future commercial development in the area will also likely encourage increases in employment in the CID. The resident CID population labor force is predominately employed in management and professional occupations, followed by sales and office occupations.

Housing Characteristics

According to the 2000 census there were a total of 517 housing units in the CID with a residential vacancy rate of only 3.7 %. This housing vacancy rate was lower than the rates for Wyandotte County (9.4 %), Jackson County (7.6 %), Clay County (4.8 %), and the KC MSA (6.3%). Reflecting the historic nature of the CID area, Census 2000 data indicates that more than 80 % of the housing units in the CID were built before 1940 compared with 12.9 % for the KC MSA.

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3.3.5 North Kansas City Unit

2055 Land Use and Location

The North Kansas City Unit is located on the left bank of the Missouri River in Clay County, Missouri. This unit protects the Downtown Airport, a portion of the City of North Kansas City, Missouri, major railroad yards, and Kansas City Power and Light Company power plant facilities. Census tracts 200 and 201, with a land area of 6.1 square miles, cover the protected area.

Population, Income and Employment Characteristics

In the year 2000, there were 4,882 persons residing in the North Kansas City Unit area. This was an increase of 13.6 % over the 1990 population of 4,299. The median age range of North Kansas City Levee Unit census tract residents is 27.3 years to 36.9 years. Median age for the KC-MSA is 35.2 years, and 35.0 years for Clay County. Approximately 13.7 % of the population in this levee unit area is in the 65 years and older age category, higher than the 10.8 % in this age category for Clay County and the 11.4 % for the KC MSA. Residents under eighteen years of age in the North Kansas City Unit account for about 7.5 % of total population compared with 25.8 % for Clay County and 26.6 % for the KC MSA. Population is expected to experience some growth over the next decade due to the new higher density housing currently planned and under development in this area. Additionally, since North Kansas City offers many services geared to attract retirees to the area, an increase in the senior population would also be expected. The North Kansas City Unit census tracts had 1999 median household incomes ranging from \$22,379 to \$29,526, significantly below the median incomes for the KC MSA (\$46,193) and for Clay County (\$48,347). Approximately 12.2 % of the North Kansas City Unit population is below poverty level, compared with 8.5 % for the KC MSA and 5.5 % for Clay County.

In 2000, approximately 26,703 people worked in the levee unit area. This is an increase of 3.2 % over the 1990 employment of 25,886. The labor force population residing in this levee unit had higher unemployment rates in 2000 (ranging from 5.4 to 6.2 %) than Clay County with 3.3 %, and the KC MSA with a rate of 2.9 %.

Housing Characteristics

In 2000, there were a total of 2,933 housing units in the North Kansas City Unit area. The vacancy rate for these housing units (9.2%) was higher than the 4.8 % vacancy rate for Clay County and the 6.3 % rate for the KC MSA. This higher vacancy rate may be due in some part to the anticipated and currently ongoing removal of some lower density units that are being replaced by new higher density units in one area of the North Kansas City Unit. The median value of owner occupied housing ranged from \$78,100 to \$112,500, compared with the KC MSA median value of \$104,700 and the Clay County median value of \$104,900. A higher percentage (20.3%) of houses in the North Kansas City Unit were built before 1940 compared with 12.9 % in the KC MSA and only 6.1 % in Clay County.

3.3.6 East Bottoms Unit

Land Use and Location

The East Bottoms Unit is located on the right bank of the Missouri River in Jackson County and protects an industrialized area of the City of Kansas City, Missouri, and some smaller residential areas. Data for census tracts 3, 4, 5.01 and 5.02 were used to describe the protected area. The land area covered by these census tracts is 10.3 square miles.

Population, Income and Employment Characteristics

Approximately 3,277 persons lived in the East Bottoms Unit in the year 2000, a decline of 19.1 % from the 1990 population of 4,054. The median age of residents in these census tracts ranges from 29.5 to 39.6 years, compared with a median age of 35.2 for both the KC MSA and Jackson County. The percent of population 65 years of age and older (13.7 %) is higher than for the KC MSA (11.4 %) and Jackson County (12.5%). The percent of population under the age of 18 years (28.4%) is above the percentages for the KC MSA and Jackson County (26.6% and 25.8% respectively). The 1999 median household incomes for these census tracts range from \$21,786 to \$36,875, lower than median household income for the KC MSA (\$46,193) and for Jackson County (\$39,277).

About 20,147 persons worked in the East Bottoms Unit in 2000, an increase of 8.3 % over the 1990 employment of 18,601 persons. The resident labor force in the East Bottoms Unit census tracts had higher unemployment rates in 2000 (13.5% to 26.6%) than for the KC MSA (2.9%) and Jackson County (5.7%). The resident labor force is employed primarily in the production/transportation occupations, followed by service occupations.

Housing Characteristics

The vacancy rate of 17.5 % for the 1,534 housing units in the East Bottoms Unit was nearly three times the KC MSA vacancy rate of 6.3 % and near two and a half times the Jackson County housing vacancy rate of 7.6 %. Median owner occupied housing value for the census tracts ranged from \$15,000 to \$92,500, lower than the median value of \$104,700 for the KC MSA and \$85,000 for Jackson County. Nearly 48 % of housing units were built prior to 1940, compared with 12.9 % for the KC MSA and 18.7 % for Jackson County.

3.3.7 Birmingham Unit

Land Use and Location

The Birmingham Unit is located on the left bank of the Missouri River in Clay County, Missouri. This unit protects the village of Birmingham, rural agricultural areas, and a recently developed industrial park. Data for census tracts 207 and 215 are representative of the protected area for this unit. These census tracts have a land area of about 18.9 square miles.

Population, Income and Employment Characteristics

The 2000 population in the Birmingham Unit was approximately 4029 persons, a 10.1 decline from the 1990 population of 4,481. The median age for the census tracts in the Birmingham Unit ranged from 35.3 to 36.0 years, slightly higher than the KC MSA median age of 35.2 and the Clay County median age of 35.0. The percent of total population aged 65 years and above (8.6%) is less than for the KC MSA (11.4%) and Clay County (10.8%).

In contrast, Birmingham residents under the age of 18 years account for 27.5% of total population, higher than the 26.6 % for the KC MSA and 25.8 % for Clay County. The 1999 median household income for these census tracts ranged from \$48,333 to \$48,463, above the KC MSA median income of \$46,193, and comparable to Clay County median income of \$48,347. About 6.1 % of the population is below poverty level, compared with the 8.5 % for the KC MSA and 5.5 % for Clay County.

In 2000, approximately 11,112 people worked in the Birmingham Unit. This was a significant increase (more than 102%) over the 5,490 workers in 1990. The resident labor force in the Birmingham Unit area had unemployment rates ranging from 4.2 to 6.5 %, higher than the KC MSA rate of 2.9 % and the Clay County rate of 3.3 %. Primary occupations for Birmingham

Unit residents are in the sales/office worker category, followed by management/professional occupations.

Housing Characteristics

Birmingham housing units totaled 1,528 in 2000. Housing units had a vacancy rate of 3.3 %, which is lower than the vacancy rate of 4.8 % for Clay County and 6.3 % for the KC MSA. The median value of owner occupied housing units ranged from \$69,300 to \$80,700, significantly less than the median value of \$104,700 for the KC MSA and \$104,900 for Clay County. About 4.2 % of the housing in the Birmingham Unit was built before 1940, compared with 12.9 % for the KCMSA and 6.1 % for Clay County.

Table 3-2 on the following page summarizes population, employment and housing characteristics of the areas protected by the levee units located on the Kansas side of the Kansas City metropolitan area. For comparison purposes, data for Wyandotte County and for the KC MSA are also displayed. Table 3-3 provides the same characteristics for levee units located on the Missouri side of the Kansas City metropolitan area. Data for Jackson and Clay Counties in Missouri and the KC MSA are shown for comparison purposes. The CID unit, located on both sides of the state line, is included in both tables.

2171 Table 3-2. Population, Employment and Housing Characteristics for Kansas Units 2000

21/1 Table 3-2. Popu	CID MO- KS Unit	Argentine Unit	Armourdale Unit	Fairfax- Jersey Cr Unit	Wyandotte County, KS	Kansas City, MO KS MSA
Population 2000	936	3,481	3,213	NA	157,882	1,776,062
% Chg 1990-2000	1,027.7%	-2.5%	-7.6%	NA	-2.5%	12.2%
Households 2000	483	1,282	986	NA	59,700	694,468
% Chg 1990-2000	1,458.1%	-3.0%	-23.0%	NA	-2.9%	14.1%
Average Number of Persons per Household	1.9	2.7	3.3	NA	2.6	2.5
Median Age— (range for multiple census tracts)	29.5 to 32.4	28.3 to 35.0	27.6 to 77.0	NA	32.5	35.2
% Under Age 18	1.7%	34.0%	33.2%	NA	28.5%	26.6%
% Over Age 65	0.8%	13.2%	7.9 %	NA	11.7%	11.4%
1999 Median Household Income—(range for multiple census tracts)	\$34,464 to \$36,625	NA to \$24,740	\$27,524 to \$102,264	NA	\$33,784	\$46,193
% Population Living Below Poverty Level (1999)	9.3%	26.4%	35.2%	NA	16.5%	8.5%
% Unemployed Resident Labor Force— (range for multiple census tracts)	NA	8.3%	NA to 8.3%	NA	8.2%	2.9%
Housing Units 2000	517	1,380	1,109	NA	65,892	740,884
Housing Vacancy Rate	3.7%	7.1%	11.1%	NA	9.4%	6.3%
Median Value of Owner Occupied Housing— (range for multiple census tracts)	NA	NA to \$67,600	\$22,600 to \$162,500	NA	\$54,300	\$104,700
% Housing Units Built Before 1940	80.6%	7.2%	32.4%	NA	18.8%	12.9%

NA – Information Not Available

2173 Source: Census 2000

Table 3-3. Population, Employment and Housing Characteristics for Missouri Units 2000

2174 Table 3-3. P	opulation, E	Lmploymen	t and Housi	ng Characteri	stics for M	issouri Uni	ts 2000
	CID MO- KS Unit	North Kansas City Unit	East Bottoms Unit	Birmingham Unit	Jackson County, MO	Clay County, MO	Kansas City, MO KS MSA
Population 2000	936	4,882	3,277	4,029	654,880	184,006	1,776,062
% Chg 1990-2000	1,027.7%	13.6%	-19.1%	-10.1%	3.4%	19.9%	12.2%
Households 2000	483	2,669	1,282	1,478	266,294	72,558	694,468
% Chg 1990-2000	1,458.1%	7.4%	-17.6%	-2.3%	5.6%	23.0%	14.1%
Average Number of Persons Per Household	1.9	1.8	2.6	2.7	2.4	2.5	2.5
Median Age—(range for multiple census tracts)	29.5 to 32.4	27.3 to 36.9	29.5 to 39.6	35.3 to 36.0	35.2	35.0	35.2
% Under Age 18	1.7%	17.5%	28.4%	27.5%	25.8%	25.8%	26.6%
% Over Age 65	0.8%	13.7%	13.7%	8.6%	12.5%	10.8%	11.4%
1999 Median Household Income- (range for multiple census tracts)	\$34,464 to \$36,625	\$22,379 to \$29,526	\$21,786 to \$36,875	\$48,333 to \$48,463	\$39,277	\$48,347	\$46,193
% Population Living Below Poverty Level (1999)	9.3%	12.2%	27.5%	6.1%	11.9%	5.5%	8.5%
% Unemployed Resident Labor Force— (range for multiple census tracts)	NA	5.4% to 6.2%	13.5% to 26.6%	4.2% to 6.5%	5.7%	3.3%	2.9%
Housing Units 2000	517	2,933	1,534	1,528	288,231	76,230	740,884
Housing Vacancy Rate	3.7%	9.2%	17.5%	3.3%	7.6%	4.8%	6.3%
Median Value of Owner Occupied Housing—(range for multiple census tracts)	NA	\$78,100 to \$112,500	\$15,000 to \$92,500	\$69,300 to \$80,700	\$85,000	\$104,900	\$104,700
% Housing Units Built Before 1940	80.6%	20.3%	47.6%	4.2%	18.7%	6.1%	12.9%

Source: Census 2000

Table 3-4 below displays estimates of employment in the year 2000 in each levee unit and the study area as a whole, and the percent change in employment between 1990 and 2000.

Table 3-4. 2000 Estimates of Employment

Unit	Employment	% Change 1990-2000
Argentine Unit	10,700	7.4%
Armourdale Unit	6,700	1.6%
Birmingham Unit	11,112	88.7%
CID MO-KS Unit	7,494	-12.0%
East Bottoms Unit	20,147	8.3%
Fairfax-Jersey Creek Unit	11,180	6.5%
North Kansas City Unit	26,703	3.2%
Study Area Total	94,036	9.4%

Source: Mid America Regional Council

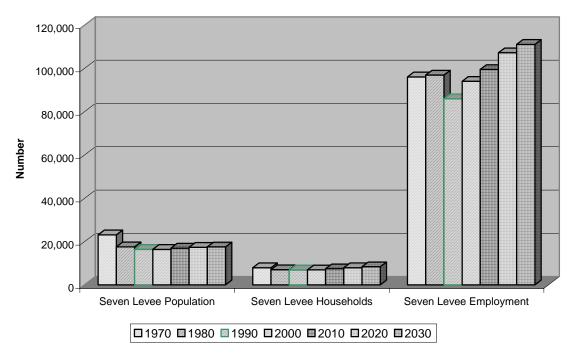
3.3.8 Study Area General Trends in Population, Household and Employment

Census data for the time period 1970 to 2000 and Mid-America Regional Council (MARC) forecasts (2010 to 2030) for the sixteen census tracts in the study area were used to describe general trends in population, households and employment. MARC is the metropolitan planning organization for the bi-state Kansas City region. MARC also serves as the association of city and county governments and its Board of Directors represents eight counties and 114 cities in the bi-state metropolitan Kansas City region. MARC provides long range planning and public policy coordination services, technical assistance, and seeks to foster understanding and cooperation in the metropolitan area on issues that extend beyond the jurisdiction of a single city, county or state.

 In 1970 the study area levee units had a total population of 23,124 persons and 7,952 households. Between 1970 and 1990, the total population and number of households in the study area declined. This trend in the study area was reflective of the national trend that occurred in the 1970's and 1980's when there were population shifts to areas outside of central city areas. After 1990 the population and number of households began to stabilize and by 2000 had increased to 16,351 persons and 6,912 households in the study area. Fluctuations also occurred in study area employment, with an overall decline from a 1970 level of 96,069 to 85,949 by 1990 and then increasing in the year 2000 to a level of 94,035. Based on MARC forecast data for the period 2000 to 2030, total employment in the seven levee unit study area is expected to increase steadily. Population and number of households in the area are expected to experience steady but modest growth.

Figure 3-1 below displays the general trends in population, households and employment, 1970 to 2030 for the study area as a whole (all seven levee unit areas).

Figure 3-1
Seven Levee Area Population, Household, and Employment Trends
1970-2030



In 1970 the study area levee units had a total population of 23,124 persons and 7,952 households. Between 1970 and 1990, the total population and number of households in the study area declined. This trend in the study area was reflective of the national trend that occurred in the 1970's and 1980's when there were population shifts to areas outside of central city areas. After 1990 the population and number of households began to stabilize and by 2000 had increased to 16,351 persons and 6,912 households in the study area. Fluctuations also occurred in study area employment, with an overall decline from a 1970 level of 96,069 to 85,949 by 1990 and then increasing in the year 2000 to a level of 94,035. Based on MARC forecast data for the period 2000 to 2030, total employment in the seven levee unit study area is expected to increase steadily. Population and number of households in the area are expected to experience steady but modest growth.

3.3.9 Navigation

The Missouri River Bank Stabilization and Navigation Project (BSNP), authorized by Congress in the Rivers and Harbors Act of 1945 was designed to prevent bank erosion and channel meandering and to provide reliable commercial navigation on the Missouri River. The purpose was to secure a continuous, 9-foot deep by 300-foot wide navigation channel for 735 miles from Sioux City, Iowa to the Missouri River mouth near St. Louis, Missouri.

Barge shipment began on the Lower Missouri River in early 1900s. The river reach between Sioux City and Omaha accounts for approximately 10% of the Missouri River origin destination freight tonnage. The reach between Omaha and Kansas City has accounted for about

40%, and the Kansas City to St. Louis reach has accounted for approximately 50% (Corps, 1998a). Major commodities transported on the Missouri River include agricultural products (farm and food products); chemicals, including fertilizers; petroleum products, manufactured goods, including building products such as cement; and bulk materials such as sand, gravel, and materials used to maintain the Missouri River BSNP.

The State of Missouri is typically an origin or destination for over half of Missouri River commercial tonnage, which excludes sand and gravel and waterway materials. About 120 docks and terminals are located on the lower Missouri River and approximately one-half of these are located are located near and downstream of Kansas City. The Port of Kansas City serves as an origin or destination for about one-third to as much as one-half of Missouri River commercial tonnage. The Kansas River is classified as a navigable stream, but no commercial navigation operates on its waters. The Blue River is defined as a Phase I navigable stream by the Corps (historically navigable), and it is listed as having up to 4 miles of navigable water (MDNR 1986).

Navigation on the Missouri is limited to the ice-free season, with a full season normally extending from April 1 to December 1 at the mouth. A full-service target flow of 41,000 cubic feet per second (cfs) is considered adequate to maintain the channel with little or no dredging. Tuttle Creek, Milford, and Perry Lakes are periodically utilized to supplement Missouri River flows below Kansas City to meet the navigation requirement and to conserve water in the main stem lakes. The navigation supplementation was taken primarily from Tuttle Creek this past year, followed by Perry Lake. Supplemental releases were stopped as the navigation season ended at the Kansas City reach on October 11, 2004.

Annual navigation benefits vary considerably. The range is from about \$16 million for an extended navigation season to a low of about -\$3 million in several years of the 1930 to 1941 drought. The average annual Missouri River navigation benefits for the Kansas City reach for the 100-year period from 1898-1997 totals approximately \$6.03 million, in comparison to Sioux City (\$1.20 million), Omaha (\$0.91 million), and Nebraska City (\$0.66 million) (Corps, March 2004).

3.3.10 Recreation

Recreation in and along the Missouri and Kansas Rivers is access limited and primarily involves boating and fishing, plus some hiking, canoeing and kayaking (primarily on the Kansas River), wildlife/bird watching, and nature interpretation. Drought or low water levels can shorten the seasonal timeframe for boat-oriented recreation because some boat ramps are inaccessible during non-navigation periods. Similar to the Missouri and Kansas Rivers, Blue River access is considered limited, although 27 miles of the Blue River corridor is in public ownership.

A 1980 proposal by the Heritage Conservation and Recreation Service (now part of the National Park Service) recommended the designation of the lower Kansas River as a "recreational river" and made a component of the National Wild and Scenic Rivers System. The plan proposed acquisition of acreages at the western end of the Argentine Levee Unit between the Turner and I-635 bridges to be used as the downstream takeout point for the recreational river. The 57-mile reach of the lower Kansas River located between I-635 and the Delaware

River was listed on the Nationwide Rivers Inventory (NRI) in 1982, and has the potential for inclusion in the National Wild and Scenic Rivers System (http://www.nps.gov/ncrc/programs/rtca/nri/). In accordance with CEQ Memorandum, August 10, 1980, which addresses the protection of rivers in the NRI, potential adverse effects to the

Kansas River were considered during the planning process.

Advocacy for increased recreational facilities within the Kansas City region has been increasing since 1991, when the local chapter of the American Society of Landscape Architects (ASLA Prairie Gateway chapter) introduced MetroGreen. MetroGreen is a proposed 1,144-mile interconnected system of public and private open spaces, greenways and trails designed to link existing trail segments within Leavenworth, Johnson and Wyandotte counties in Kansas and Cass, Clay, Jackson and Platte counties in Missouri to provide increased travel options for walkers, joggers, and cyclists. Segments of 13 MetroGreen trails consisting of over 85 miles have been constructed within the Kansas City metropolitan area. Many trail segments originate in a park and are subsequently lengthened to connect to additional parks or features to provide a contiguous trail system. Proponents of the trails and greenways system have proposed the development of recreational hike and bike trails on the existing levee system. There are currently no recreational facilities located on the existing levee units.

Existing recreational facilities within the immediate vicinity of the project area include segments of the Riverfront Heritage Trail, associated interconnected parks, and a variety of parks that are not connected to the Trail. The Riverfront Heritage Trail is a 10-mile bistate system of riverfront pedestrian and bicycle (multi-use) trails that comprise the hub of the downtown Kansas City trail system. Parks connected to the Trail include Lewis and Clark Historic Park (Kaw Point Park), Richard L. Berkley Riverfront Park (Berkley Park), Case Park (Clark's Point), Huron Park, and River Bluff Park. Berkley Park is the northeast terminus of the trail, which extends west along the Missouri River to the River Market and forks into two directions: south outside of the protected area, and west into the CID.

Kaw Point Park and Berkley Park are the only parks connected to the Trail that are located within the protected area. Kaw Point Park is located in the Fairfax Levee Unit adjacent to the CID Levee Unit. Berkley Park is located in the East Bottoms Levee Unit. Parks located within the protected areas of levee units are presented below in Table 3-5.

Table 3-5. Parks Located Within the Levee Units

Levee Unit	Park	Riverfront Heritage Trail Connection	
	Clopper		
Argentine	Emerson		
	Alvery	No	
	Ruby		
	Silver City		
Armourdale	Kaw	No	
Armourdale	Shawnee		
CID: MO-KS	West Terrace	No	
East Bottoms	Riverfront (Berkley)	Yes	
	Nicholson	No	
	Heim	INO	
Fairfax-Jersey Creek	Lewis and Clark Historic (Kaw Point)	Yes	
North Kansas City	Macken	No	
	Children's Fountain		
	Dagg	190	
	River Forest		

Sources: Unified Government of Wyandotte County and Kansas City, Kansas. 2005. City of Kansas City, Missouri. 2004.

3.3.11 Utilities

The project area contains numerous utilities that provide drinking water, fuel, power, and other necessities to the greater metropolitan Kansas City area. The Argentine levee unit is the only unit in this study that contains utilities proposed for relocation over the levee due to their existing alignment below the levee. The location and nature of the proposed relocations include the following:

- Station 12+80 A 12" gas line buried 14 feet below the levee toe will be relocated over the levee.
- 232323242325

2312 2313

23142315

23162317

2318

23192320

23212322

- Station 36+20 A 4" gas line buried 10 feet below the levee toe will be relocated over the levee.
- 23262327
- Sta 71+80 An 8" petroleum line buried 14 feet below the levee toe will be relocated over the levee.
- 2328 2329
- Sta 214+70 A 24" gas line buried 4 feet below the levee toe will be relocated over the levee.
- 23302331
- Sta 215+20 A 10" water line buried 6 feet below the levee toe will be relocated over the levee.
- 2332 2333
- These relocations will be conducted landside of the Kansas River. Relocation of these utilities will not require work within waters of the U.S.

4. Environmental Consequences

4.1 Overview

The seven levee units that comprise the protective works of Kansas City, Kansas and Kansas City, Missouri, were constructed between the 1940's and the mid 1950's. The protective works have been part of the landscape for at least 50 years. Improvements to these levee units vary considerably, and were accomplished from the early 1940's to the late 1970's. The recommended project plan is a combination of preferred alternatives selected for each levee unit. The environmental consequences of these individual alternatives under the recommended plan are discussed below.

4.2 Geology

4.2.1 Argentine Levee Unit Alternative

No significant impacts to geology would be anticipated from the preferred alternative selected for the Argentine levee unit. The nominal 500-year+3 levee raise and construction of underseepage control measures would include the construction of buried collectors at three locations, modifications to two pump plants, and the removal and replacement of one pump plant. Geology would not be impacted because the excavation and construction activities associated with any of the proposed alternatives would be conducted within the soil layers above bedrock. No post-construction impacts to geology would be anticipated from the levee raise or operation or underseepage controls within the Argentine unit.

4.2.2 East Bottoms Levee Unit Alternative

No significant impacts to geology would be anticipated from the preferred alternative selected for the East Bottoms levee unit. The preferred alternative is the installation of pressure relief wells along the landside levee toe. Drilling through the soil to bedrock depth or to a depth just above bedrock (80 to 120 feet) would be required to facilitate relief well installation. No impacts to geology would be anticipated as drilling would be conducted through the soil layers to a depth above bedrock. No post-construction impacts to geology would be anticipated from the operation of pressure relief wells.

4.2.3 Fairfax-Jersey Creek BPU Floodwall Alternative

No significant impacts to geology would be anticipated from the preferred alternative selected for the Fairfax-Jersey Creek BPU Floodwall. The construction of an additional row of piles and a foundation slab extension would require shallow excavation within the soil above bedrock. No post-construction impacts to geology would be anticipated as a result of the pile installation and foundation slab extension.

4.2.4 Fairfax-Jersey Creek Sheetpile Wall Alternative

No significant impacts to geology would be anticipated from the preferred alternative selected for the Fairfax-Jersey Creek sheetpile wall. The preferred alternative is the installation of a new, open cell sheetpile wall landside of the existing wall. Sheetpile would be driven into the existing stability berm through the soil to a depth above bedrock. No post-construction impacts to geology would be anticipated from sheetpile wall installation.

4.2.5 North Kansas City Unit – Harlem Alternative

No significant impacts to geology would be anticipated from the preferred alternative selected for the North Kansas City levee unit—Harlem site. A buried collector would require relatively shallow excavation. No drilling to bedrock or to a depth above bedrock would be required. No post-construction impacts to geology would be anticipated from the buried collector operation.

4.2.6 North Kansas City – National Starch Site Alternative

No significant impacts to geology would be anticipated from the preferred alternative selected for the National Starch site. The preferred alternative for this unit is the installation of pressure relief wells and pump station construction to control underseepage pressures. Drilling through the soil layers to bedrock depth or to a depth just above bedrock (80 to 120 feet) would be required to facilitate relief well installation. Shallow excavation would be required for pump station construction. No post-construction impacts to geology would be anticipated from the operation of pressure relief wells and a pump station.

4.2.7 Armourdale Levee Unit Raise Alternatives

No significant impacts to geology would be anticipated from any of the raise alternatives proposed for the Armourdale unit. The tentative preferred alternative is the nominal 500-year+3 levee raise and underseepage controls. All alternatives would require a landside earthen levee raise, floodwall modification or replacement, I-wall installation, pump station modification or replacement, and relief wells to be installed to control underseepage pressure. Relief well installation is the only construction activity that would require intensive drilling, and similar drilling would be conducted for each raise alternative. Drilling through the soil layers to bedrock depth or to a depth just above bedrock (80 to 120 feet) would be required to facilitate relief well installation. No post-construction impacts to geology would be anticipated from any levee raise alternatives or the operation of underseepage controls.

4.2.8 Central Industrial District Levee Unit Raise Alternatives

No significant impacts to geology would be anticipated from any of the raise alternatives proposed for the Central Industrial District levee unit. The tentative preferred alternative is the nominal 500-year+3 levee raise and underseepage controls. All alternatives would require a landside earthen levee raise, floodwall modification or replacement, pump station modification or replacement, and relief wells to be installed to control underseepage pressure. No I-walls would be installed for the CID levee improvements. Relief well installation is the only construction activity that would require intensive drilling, and similar drilling would be conducted for each raise alternative. Drilling through the soil layers to bedrock depth or to a depth just above bedrock (80 to 120 feet) would be required to facilitate relief well installation. No post-construction impacts to geology would be anticipated from any levee raise alternatives or the operation of underseepage controls.

4.2.9 Proposed Borrow Area

No significant impacts to geology would be anticipated from the no action alternative or any of the alternatives that require soil borrowing. Excavation depths within the proposed borrow to facilitate the construction of the preferred alternative are not anticipated to exceed ten feet. The depth of bedrock is variable and estimated at 80 to 120 feet below the ground surface.

No impacts to geology as a result of soil borrowing to construct the preferred alternative are anticipated to occur after borrow activities are completed.

4.3

For all of the preferred alternatives proposed for the levee units, there is a low probability for the inadvertent loss of a small amount of soil into the adjacent waterway or terrestrial habitat. Temporary erosion controls such as silt fencing and staked straw bales would be used to divert flow from exposed soils, temporarily store flows, or otherwise minimize erosion and sediment runoff from construction areas to prevent the introduction of sediment and construction debris into the adjacent waterway, wetlands, and riparian resources. Disturbed areas would be graded and seeded with grass (brome, rye, and fescue) upon the completion of construction. Best Management Practices would prevent the introduction of fuel, or chemicals from construction equipment into the adjacent waterway. To further avoid or otherwise minimize impacts to water resources and water quality, construction equipment would be operated to minimize the loss of soil, petroleum products, or other deleterious material into the waterway and adjacent resources.

4.3.1 Argentine Levee Unit Alternative

Water Resources and Water Quality

No significant impacts to water resources or water quality would be anticipated from the preferred alternative selected for Argentine unit. The preferred alternative for this unit is the nominal 500-year+3 levee raise and underseepage controls. The construction of overtopping reliability improvements including earthen levee, floodwalls and I-walls, would be primarily conducted from the top of the existing levee, or landside of the existing levee, which would contain soil and sediment and prevent their introduction into the Kansas River. Pump station replacement and underseepage control features would serve to return Kansas River seepwater back into the River. Work to be potentially conducted below the ordinary high water mark (OHWM) of the Kansas River involves the replacement of the box culvert that comprises the outfall of the Argentine pump station. This work would be subject to considerations pursuant to Section 10 of the Rivers and Harbors Act. This levee unit has been extensively studied to determine the nature and location of contamination from hazardous waste. Contaminated material including soil, storage tanks, and other media is planned for removal and proper disposal to prevent the contamination of the adjacent waterway and terrestrial resources. Any trash or contaminated soil encountered during construction must be excavated and disposed of in an appropriate landfill.

4.3.2 East Bottoms Levee Unit Alternative

No significant impacts to water resources and water quality would be anticipated from the preferred alternative selected for the East Bottoms unit. The preferred alternative is the installation of relief wells landside and downgradient of the existing levee within the existing right-of-way, which would provide containment for disturbed soil during construction. This alternative is an augmentation to an existing water collection system. A relief well system would collect Blue River water that seeps through the levee, and subsequently discharge the water back to the Blue River using portable diesel pumps to keep the seepage flow off-site. Groundwater contamination is known to be present within the area of proposed construction. The location of the proposed relief wells is located a considerable distance west- and upgradient of known contaminant plumes. Therefore, relief wells should have no impact on the existing groundwater plumes under transient or flowing conditions, and no significant impacts to hazardous waste

would be anticipated from the construction and operation of relief wells to provide underseepage control for the East Bottoms levee unit. No significant post-construction impacts to water resources or water quality are anticipated from the installation of relief wells.

4.3.3 Fairfax-Jersey Creek Board of Public Utilities Floodwall Alternative No significant impacts to water resources and water quality would be anticipated from the preferred alternative proposed for the Fairfax-Jersey Creek BPU floodwall. The preferred alternative consists of strengthening the existing floodwall by installing an additional row of piles and a foundation slab extension from the landward side of the existing floodwall, which would provide containment for sediment and debris during construction. The preferred alternative is not anticipated to impact water resources or water quality during the construction process, or post-construction.

4.3.4 Fairfax-Jersey Creek Sheetpile Wall Alternative

No significant impacts to water resources and water quality would be anticipated from the preferred alternative selected for the Fairfax-Jersey Creek sheetpile wall. New open cell sheetpiling would be driven into the soil landside of the existing sheetpile wall from the river using a crane. A small amount of soil may incidentally enter the Missouri River as a result of sloughing while driving new sheetpile, excavating, and filling voids. A temporary, localized increase in turbidity could occur during sheetpile installation. However, no significant impacts to water resources or water quality are anticipated and the new sheetpile wall would prevent the adjacent land from sloughing into the river during a high water event due to sheetpile wall failure as a result of scouring along the existing sheetpile wall.

4.3.5 North Kansas City Levee Unit – Harlem Alternative

No significant impacts to water resources and water quality would be anticipated from the preferred alternative selected for the Harlem area. The preferred alternative for this site is the construction of a buried collector system along the landside toe of the levee to intercept seepage. Buried collector installation would occur landside and downgradient of the existing levee between the levee and the fence that borders the adjacent property, which would contain disturbed soil and prevent it from entering the Missouri River. The buried collector would operate only during flood events. Water from the Missouri River that seeps through the levee would be collected and pumped back into the river using portable diesel pumps. The quantity of water that would be returned to the river is variable and depends on the amount of water that seeps through the levee. No hazardous waste is located in the area of the proposed construction. No significant impacts to water resources and water quality are anticipated as a result of the construction or operation of the buried collector. The construction of this underseepage control feature would protect North Kansas City from underseepage failure of the levee at Harlem and the release of large amounts of sediment and manufacturing chemicals and materials into the Missouri River.

4.3.6 North Kansas City Levee Unit – National Starch Site Alternative No significant impacts to water resources and water quality would be anticipated from the preferred alternative selected for the National Starch site. The preferred alternative for this site is the installation of pressure relief wells and the construction of a pump station. The pressure relief wells and pump station would be constructed landside and downgradient of the existing levee, which would help prevent soil and construction debris from entering the Missouri

River. Drilling to a depth of 80 to 100 feet would be required for relief well installation. Shallow excavation would facilitate pump station construction. An outlet structure may be constructed riverside at the toe of the levee and a conveyance path may be excavated to allow pumped seep water to reenter the river. If constructed, the conveyance path would be lined with rock to protect the bank from eroding and headcutting towards the levee. A similar outlet design is present upstream at +/- station 272+00 to discharge seep water from the existing pump stations.

After construction, the relief well system would collect river water that seeps through the levee during flood events and discharge it back over the levee into the Missouri River. Water quality would not be adversely impacted from this process. There is no known soil or groundwater contamination that would be impacted by relief well or pump station installation or operation.

4.3.7 Armourdale Levee Unit Raise Alternatives

No substantial impacts to water resources and water quality would be anticipated from any of the raise alternatives proposed for the Armourdale unit. All raise alternatives would require a landside earthen levee raise, floodwall modification or replacement, I-wall installation, pump station modification or replacement, and relief wells or a buried collector system to relieve underseepage pressure. The tentatively selected preferred alternative for Armourdale is the 500year+3 levee raise. This alternative provides overtopping protection for the Armourdale unit and equals the levee raise height selected for the Argentine unit, and the proposed raise of the Central Industrial District levee unit. With the exception of floodwall replacement, excavation to facilitate construction would be conducted landside of the levee. Floodwall replacement requires an approximate seventy-five foot excavation riverside of the existing floodwalls. A small amount of soil may inadvertently enter the Kansas River during excavation, borrow placement or construction and result in a localized, temporary increase in turbidity. However, no significant impacts to water resources or water quality would be anticipated from the construction of the preferred alternative. No adverse post-construction impacts from the preferred alternative are anticipated. The preferred alternative would protect the Armourdale unit from overtopping and underseepage failure of the levee. Levee failure would significantly impact water quality within and downstream of the Armourdale levee unit.

4.3.8 Central Industrial District Levee Unit Raise Alternatives

No substantial impacts to water resources or water quality would be anticipated from any of the levee raise alternatives formulated for the CID unit. Similar to the Armourdale alternatives, the CID alternatives consist of incremental levee raises. The tentatively selected preferred alternative for CID is the nominal 500year+3 levee raise. This alternative provides overtopping protection for the Armourdale unit and equals the levee raise height selected for the Argentine levee unit and the proposed raise of the Armourdale levee unit. With the exception of floodwall replacement, excavation to facilitate construction would be conducted landside of the levee. Floodwall replacement requires an approximate thirty foot riverside excavation. I-walls would not likely be constructed for improvements to the CID levee unit. A small amount of soil may inadvertently enter the Kansas River during excavation, borrow placement or construction and result in a localized, temporary increase in turbidity. However, no significant impacts to water resources or water quality would be anticipated from the construction of the preferred

alternative. No adverse post-construction impacts from the preferred alternative are anticipated. Water that seeps through the levee would be pumped back into the Kansas River during high water events using portable diesel pumps. The preferred alternative would protect the CID from overtopping and underseepage failure of the levee. Levee failure would significantly impact water quality within and downstream of the CID levee unit due to the heavily industrialized nature of this unit.

4.3.9 Proposed Borrow Area

Soil borrowing is not anticipated to significantly impact water quality. Existing activities within the proposed borrow area includes excavating, hauling, grading, and disk harrowing. Concurrent excavation and hauling activities would be conducted when practicable during construction. Excavation would occur landside of the foreshore adjacent to the Kansas River toward the interior of the borrow area, and the surrounding land elevation would provide for additional soil containment. Therefore, if on-site soil stockpiling would need to occur, sediment would be contained on the land and would not runoff into the Kansas River and impact water quality. Temporary erosion control features and Best Management practices as mentioned in section 4.3 would be used to avoid, or otherwise minimize impacts water resources and water quality.

4.4 Air Quality

No significant impacts to air quality would be anticipated from any of the preferred alternatives, or tentatively preferred alternatives proposed for the Kansas Citys' levee units. All of the preferred alternatives would cause a short-term, temporary air quality impact from construction as a result of emissions and dust generated from the operation of excavators, haul trucks, graders and similar earth moving heavy equipment. Levee raise preferred alternatives would be anticipated to have a greater construction related air quality impact relative to nonlevee raise preferred alternatives as increased emissions and dust would likely be generated due to greater borrow soil requirements and construction material requirements. Increased dust would occur on haul roads and areas of clearing and excavation, especially if construction was conducted during a dry period. The watering of road segments could be implemented to minimize the impact of dust and windblown particulate matter associated with construction. Implementation of the preferred alternative would conform to National Ambient Air Quality Standards. Post-construction air quality impacts are not anticipated to be significant. These impacts would result from the operation of pump plants and portable, diesel powered pumps used to pump seep water out of buried collector systems and back into the Missouri, Kansas, or Blue Rivers during flood events.

4.5 Noise

4.5.1 Argentine Levee Unit Preferred Alternative

No significant noise impacts would be anticipated from the preferred alternative selected for the Argentine levee unit. Noise impacts as a result of the nominal 500-year+3 levee raise would be anticipated to be adverse but would primarily consist of short-term, construction noise impacts. The proposed levee improvement alternatives would be located primarily adjacent to commercial industry. Sensitive noise receptors include the residential areas located adjacent to stations +/- 0+00 to 30+00, and station 285+00. These residences are located adjacent to the Argentine rail yard. Work proposed near station 285+00 includes floodwall and stoplog gap

removal and replacement, and I-wall and buried collector construction. This construction would be conducted north of the rail yard trackage. Construction proposed between stations +/- 0+00 and 30+00 would consist of I-wall construction and stoplog removal and replacement. This construction would be conducted south of the rail yard trackage. Noise buffering is provided by the width of the existing right-of-way, which increases the distance between the construction and the residences, and the dense trees that border the northern portion of the subdivision. No significant noise impacts are anticipated from the operation of levee improvements.

4.5.2 East Bottoms Levee Unit Preferred Alternative

No significant noise impacts are anticipated from the preferred alternative selected for the East Bottoms levee unit. The preferred alternative for this unit is the installation of pressure relief wells. Noise impacts would primarily consist of short-term construction noise. The location of relief well installation is adjacent to the Bayer CropScience Manufacturing, Research and Development Center (Bayer), which is developed on 236 acres of land just north of the Blue River. No residences or sensitive noise receptors are located within the vicinity of the proposed construction area. The installation of pressure relief wells is anticipated to blend with the existing noise generated by manufacturing processes and associated activities. No significant noise impacts are anticipated from the operation of pressure relief wells.

A.5.3 Fairfax-Jersey Creek Board of Public Utilities Floodwall Alternative No significant noise impacts are anticipated from the preferred alternative selected for the Fairfax-Jersey Creek BPU floodwall. The preferred alternative is to strengthen the existing floodwall with an additional row of piles and a foundation slab extension. Noise impacts are anticipated to be temporary, construction related impacts. Sensitive noise receptors in the vicinity of construction include an apartment complex and cemetery. The apartment complex is located south of Esplanade Street and the Union Pacific Railroad trackage within the 66115 zip code, about 0.3 miles south of the area of proposed construction. Memorial Park Cemetery is located at 3223 North 18th Street, about 0.2 miles southwest of the proposed construction. The apartment complex and cemetery should receive noise buffering due to the distance of these facilities from the proposed construction and the trees that surround these areas. The BPU infrastructure adjacent to the floodwall would serve as a barrier to reduce noise propagation from the construction area. Existing noise within the vicinity of the proposed construction, apartment complex, and cemetery includes railroad and truck traffic to facilitate industry.

No significant noise impacts are anticipated due to the distance between the sensitive noise receptors and the proposed construction area, existing noise buffers and existing sources of periodic noise within this area. Upon completion of the floodwall improvements, there would be no further noise impacts as a result of project requirements.

4.5.4 Fairfax-Jersey Creek Sheetpile Wall Alternative

No significant noise impacts are anticipated from the preferred alternative selected for the Fairfax-Jersey Creek sheetpile wall. The preferred alternative is the installation of an open cell sheetpile wall. Noise impacts are anticipated to short-term and temporary as a result of construction activities. Adverse noise impacts from construction are anticipated due to the location of Kaw Point Park near the area of proposed construction. Noise impacts to recreation as a result of the preferred alternative selected for this feature are discussed below and in detail

in section 4.17.4. For the open and closed cell sheetpile wall installations, the use of a hydraulic or vibratory pile driver would be anticipated to significantly lessen the noise impact of sheetpile driving.

The location of sheetpile installation is adjacent to an industrial area primarily used for food processing, storage, and transport, which receives moderate to heavy truck traffic. Additional existing noise sources include vehicular traffic (Interstate 70, Fairfax Trafficway, and associated roads), and periodic air traffic to and from the Downtown Airport. Sensitive noise receptors within the vicinity of the proposed construction area include adjacent businesses, residences and Kaw Point Park.

The impulse noise generated from sheetpile driving would contrast the traffic and manufacturing noise, and periodic aircraft noise within the area. The nearest residences are located about 0.5 miles west of the sheetpile wall. Residents within the 66101 zip code, located outside of the Fairfax-Jersey Creek protected area, may receive noise impacts from construction-related activities. However, potential impacts are not anticipated to be significant due to the distance between residents and the area of proposed construction. The distance from the sheetpile wall to residences will lessen the construction noise levels. Kaw Point Park and associated walking trails are located approximately 0.1 miles from the proposed construction area. Construction activities and noise may temporarily annoy canoeists or boaters on the Kansas and Missouri Rivers, and park visitors, particularly if sheetpile installation were conducted during the spring or summer months. Conducting sheetpile installation during the fall-winter seasonal timeframe, in which the Missouri and Kansas Rivers and park are less utilized, would lessen the impact of construction-generated noise. Adjacent businesses will be subject to short-term construction noise. Noise levels would return to their previous level following construction.

4.5.5 North Kansas City Levee Unit – Harlem Alternative

No significant noise impacts are anticipated from the preferred alternative selected for the North Kansas City levee unit Harlem area. The preferred alternative at this location is the installation of a buried collector system. The noise generated from the construction of this feature would result from excavation. The location of proposed construction is between the Hannibal Bridge and the A.S.B. Bridge, which are adjacent to the Broadway Bridge and Heart of America Bridge, respectively. The Downtown Airport is located just west of the Broadway Bridge. An active Norfolk and Western rail line is located north of the proposed construction. The area adjacent to the proposed construction is comprised primarily of businesses, and some residences, within the 64116 zip code. Light industrial manufacturing processes, including metal fabrication (i.e., forming, grinding, and welding) occur adjacent to the proposed construction. Vehicular, rail, and air traffic are relatively common within this area.

Sensitive noise receptors within the vicinity of the proposed construction include a potential elderly population, an apartment building, and a church. Thirteen and one-half percent of zip code 64116 is comprised of an elderly population over age 65 (Census 2000). The median age of the residents who comprise the block group between the Hannibal Bridge and the A.S.B. Bridge is about 27.3 years (Census 2000). The apartment building is located just north of the proposed construction area. The church is located approximately 0.7 miles north of the proposed

construction. Construction-related noise may annoy residents adjacent to the proposed construction area.

 Increased noise will occur during flood events following construction, as portable diesel-powered pumps would be used to remove water from the buried collectors. The noise generated by the pumps would not be considered significant as it would occur adjacent to the Missouri River only during flood events.

4.5.6 North Kansas City Unit – National Starch Alternative

No significant noise impacts would be anticipated from the preferred alternative selected for the National Starch site. The preferred alternative is the installation of relief wells and a pump station. The National Starch site is located between the Paseo Bridge and the Heart of America Bridge. The area of proposed construction is located adjacent to an existing haul route, active rail line, and manufacturing facilities. Construction noise is anticipated to blend with the existing noise generated by manufacturing and associated activities. No sensitive noise receptors are located within the vicinity of the proposed construction area. There is a low probability that construction would disrupt recreation on the Missouri River, due to the low amount of river recreation in this reach and the existing noise that occurs within this area. Post construction noise impacts are short-term and temporary and would consist of the operation of portable diesel pumps to return collected seepwater to the Missouri River. Pump operation is not anticipated to significantly increase the noise levels within the vicinity of the National Starch property.

4.5.7 Armourdale Levee Unit Raise Alternatives

No significant noise impacts would be anticipated from any of the alternatives proposed for the Armourdale unit. All of the proposed alternatives would cause short-term, construction related impacts. The tentatively preferred alternative for this unit is the nominal 500-year+3 levee raise including underseepage controls. A greater amount of real estate and quantities of floodwalls, I-walls, and retaining walls are generally required as the raise alternatives increase from the nominal 500year+0 to the nominal 500year+3. The increased excavation, earth moving and construction required to construct an incrementally higher raise generally results in increased noise relative to the other levee raise alternatives considered. All raise alternatives would require a landside earthen levee raise, floodwall modification or replacement, I-wall installation, pump station modification or replacement, and the same number of relief wells to be installed to control underseepage pressure. Drilling through the soil layers to a depth just above bedrock (80 to 120 feet) would be required to facilitate relief well installation. Similar drilling would be conducted for each raise alternative.

The tentatively selected preferred alternative for this unit is the 500year+3 raise. Although this alterative would generate more construction noise relative to the other alternatives proposed for this unit, noise impacts are not considered significant as the Armourdale unit is heavily industrialized, and industrial and construction noise is relatively common within this levee unit. Post construction noise would occur from the operation of diesel powered pumps during flood events for underseepage control. The operation of pumps would not be anticipated to cause a significant noise impact.

4.5.8 Central Industrial District Levee Unit Raise Alternatives

No significant impacts noise impacts would be anticipated from any of the levee raise alternatives proposed for the Central Industrial District levee unit. The tentatively preferred alternative is the nominal 500-year+3 levee raise with underseepage controls. All of the proposed alternatives would cause a short-term, temporary noise impact during construction. Similar to the Armourdale alternatives, the CID alternatives consist of incremental levee raises. An incrementally higher levee raise generally results in increased construction noise due to increased excavation and soil placement. However, the length of floodwall replacement and number of relief wells required are anticipated to be the same for all raises above the nominal 500-year+0 raise. Construction of the tentatively preferred alternative would be anticipated to emit slightly more noise relative to the other alternatives proposed for this unit. However, this levee unit is heavily industrialized and construction and post-construction impacts are not anticipated to be significant. Post construction noise would occur from the operation of diesel powered pumps during flood events for underseepage control. The operation of pumps would not be anticipated to cause a significant noise impact within this levee unit.

4.5.9 Proposed Borrow Area

Soil borrowing activities conducted within the proposed borrow area are not anticipated to generate significant noise impacts. Excavation, hauling, grading, and crop cultivation already occur within the proposed borrow area. Soil borrowing to construct the preferred alternatives would result in more intensive excavation and earth moving activities than those currently conducted within the borrow area. Similar noise levels would be generated over a longer continuous timeframe. The additional traffic noise generated from the transport of soil from the borrow area to the levee units would be in addition to the hauling activities that already occur along the proposed haul route. This increased noise would be temporary and generally localized and is not anticipated to be significant.

4.6 Visual Quality

For all of the preferred alternatives selected for the individual levee units, the stockpiling of soil and the presence of heavy equipment required for construction would be an adverse, temporary visual impact.

4.6.1 Argentine Levee Unit Alternative

No significant visual quality impacts to visual quality are anticipated from the preferred alternative selected for the Argentine levee unit. The preferred alternative for the Argentine levee unit is the nominal 500-year+3 levee raise and underseepage controls. Floodplain encroachment was minimized by using I-walls and floodwalls for the nominal 500-year+3 levee raise. I-walls and floodwalls allow a vertical raise while minimizing and avoiding real estate impacts landside of the existing levee. An earthen levee raise designed to achieve the elevations provided by I-walls and floodwalls would require a larger horizontal footprint and terrestrial habitat impacts for levee construction. The existing Kansas Citys' levees average approximately +/- 15 feet in height. The nominal 500-year+3 levee raise alternative generally results in an approximate four to six foot raise along the existing levee and floodwalls.

The nominal 500-year+3 preferred alternative would result in a moderate visual quality impact compared to the other levee raise scenarios considered and the approximate height of the

existing levee. Most of the levee is not visible from the Kansas River due to the tree growth along the River in this reach. Therefore, most levee improvements would not likely be evident to the public except during fall-winter seasonal timeframe when deciduous trees drop their leaves and river recreation is low. In areas where tree/shrub growth is not dense or is nonexistent, a levee raise could further minimize the view of industry from the river. Industry considers the levees a necessity because of the flood damage protection they provide. Implementation of the preferred alternative will result in the construction of additional non-natural features along the Kansas River. The construction of levee improvements would require the addition of relatively permanent non-natural features adjacent to the river. Argentine is an industrialized levee unit. This impact is not considered significant as a levee and associated flood damage reduction features have been in-place within Argentine levee unit and along the Kansas River and associated waterways since the 1950's. Changes to the visual quality of the landscape adjacent to the Kansas River are not anticipated to adversely impact the potential for the inclusion of the River into the National Wild and Scenic Rivers System. Short-term construction related aesthetic impacts include the presence of heavy equipment and the stockpiling of soil.

4.6.2 East Bottoms Levee Unit Alternative

No significant impacts to visual quality are anticipated as a result of the preferred alternative selected for the East Bottoms levee unit. The preferred alternative is an augmentation to an existing collector system and consists of the installation of pressure relief wells, which would be located landward and downgradient of the existing levee. Less than one-quarter acre of maintained grass (brome, fescue, and rye), would be converted to relief wells and manholes. Relief wells generally exhibit a low profile within the landscape. Short-term construction related aesthetic impacts include the presence of heavy equipment and the stockpiling of soil. The visual impact resulting from relief well installation is not anticipated to be insignificant due to their relatively low profile within the landscape and their installation location downgradient of the existing levee where they would not be easily viewed from the river.

A.6.3 Fairfax-Jersey Creek Board of Public Utilities Floodwall Alternative No significant impacts to visual quality are anticipated as a result of the preferred alternative selected for the Fairfax-Jersey Creek BPU floodwall. The preferred alternative for this location is to strengthen the existing floodwall with an additional row of piles and a foundation slab extension. The preferred alternative would not significantly alter the existing visual quality within this reach. Floodwall improvements would be constructed landside (behind) the existing wall, and these structural modifications would not be easily viewed from the Missouri River. Short-term construction-related impacts include the presence of heavy equipment and the stockpiling of soil required for backfilling. No significant impacts to visual quality are anticipated as a result of the preferred alternative due to the location of the proposed improvements landside of the existing floodwall.

4.6.4 Fairfax-Jersey Creek Sheetpile Wall Alternative

No significant visual quality impacts would be anticipated from the preferred alternative selected for the Fairfax-Jersey Creek sheetpile wall. The open cell sheetpile wall is the preferred alternative for this location within the Fairfax-Jersey Creek levee unit. This alternative would not be anticipated to significantly change the existing visual quality as an existing sheetpile wall is already in place. A new sheetpile wall would provide a short-term increase in aesthetics as the

the existing sheetpile wall is rusted and tie-backs are exposed. The aesthetics and integrity of the new sheetpile wall would decrease over time. Short-term visual quality impacts would occur due to the land disturbance within the vicinity of the existing sheetpile wall required for construction. A crane would be deployed in the Missouri River to drive new sheetpile sections. Areas disturbed by excavation would be graded and seeded when construction is complete. The preferred alternative is not anticipated to cause significant visual quality impacts as the new sheetpile wall would be installed landside of an existing sheetpile wall. Visual quality impacts would be short-term and construction-related.

4.6.5 North Kansas City Levee Unit – Harlem Alternative

No significant visual quality impacts are anticipated from the preferred alternative selected for the North Kansas City levee unit Harlem preferred alternative. The preferred alternative is the installation of a buried collector, which would result in a minor visual quality impact, as only a manhole would be visible after backfilling of soil, grading, and seeding. This feature would be located landside and downgradient of the existing levee and would not be readily visible from the Missouri River. A portable diesel pump would be present after construction is completed during flood events to return water that seeps through the levee back into the Missouri River. Short-term construction related impacts include the stockpiling of soil and the presence of heavy equipment. The preferred alternative selected for the Harlem site is not considered significant due to its location downgradient of the existing levee and the relatively low profile of this feature within the landscape.

4.6.6 North Kansas City Levee Unit – National Starch Alternative

No significant visual quality impacts are anticipated from the preferred alternative selected for the North Kansas City National Starch preferred alternative. The preferred alternative is the installation of pressure relief wells and the construction of a pump station. These features are anticipated to have a relatively minor visual quality impact and they would not be readily visible from the Missouri River. The pressure relief wells and pump station would be constructed landside and downgradient of the existing levee. Relief wells generally exhibit a low profile within the landscape. An outlet structure may be constructed riverside at the toe of the levee and a conveyance path may be excavated and lined with rock to allow pumped seepwater to enter the river instead of eroding the land and headcutting up the riverside slope. Short-term construction related impacts include the stockpiling of soil and the presence of heavy equipment (i.e. excavators and graders). The preferred alternative is not anticipated to cause significant visual quality impacts due to their location landside of the existing levee, which is not readily visible from the Missouri River.

4.6.7 Armourdale Levee Unit Raise Alternatives

No significant visual quality impacts would be anticipated from any of the raise alternatives proposed for the Armourdale unit. All of the proposed raise alternatives would impact the visual quality of this unit. The tentatively preferred alternative for this unit is the nominal 500-year+3 levee raise including underseepage controls. The raise would be accomplished by constructing earthen levee, floodwalls, and I-walls. Floodplain encroachment was minimized by using I-walls and floodwalls for the nominal 500-year+3 levee raise. I-walls and floodwalls allow a vertical raise while minimizing and avoiding real estate impacts landside of the existing levee. New floodwall would be constructed landside of existing floodwall. The

nominal 500-year+3 levee raise alternative generally results in an approximate four to six foot raise along the existing levee and floodwalls. An earthen levee raise designed to achieve the elevations provided by I-walls and floodwalls would require a larger horizontal footprint and greater potential terrestrial habitat impacts for levee construction. The nominal 500-year+3 height increase is considered moderate relative to the existing height of the overtopping reliability features within this levee unit. Underseepage controls are generally not visible after construction. Short-term construction related aesthetic impacts include the presence of heavy equipment and the stockpiling of soil. Post-construction impacts to visual quality include a moderate height increase of existing overtopping features within a heavily industrialized unit. Levee failure would result in a significant adverse impact to the aesthetics of the Armourdale levee unit.

4.6.8 Central Industrial District Levee Unit Alternatives

No significant visual quality impacts would be anticipated from any of the raise alternatives proposed for the Central Industrial levee unit. All of the proposed raise alternatives would impact the visual quality of this unit. The tentatively preferred alternative for this unit is the nominal 500-year+3 levee raise including underseepage controls and results in visual quality impacts similar to those anticipated for the Armourdale levee unit. The levee raise would be accomplished by constructing earthen levee, floodwalls. No I-walls would be constructed within the CID unit. Floodwalls would be constructed landside of existing floodwalls to allow a vertical raise while minimizing and avoiding real estate impacts landside of the existing levee. The nominal 500-year+3 levee raise alternative generally results in an approximate four to six foot raise along the existing levee and floodwalls. An earthen levee raise designed to achieve the elevations provided by floodwalls would require a larger horizontal footprint and potential increased terrestrial habitat impacts for levee construction. The nominal 500-year+3 height increase is considered moderate relative to the existing height of the overtopping reliability features within this levee unit. Underseepage controls are generally not visible after construction. Short-term construction related aesthetic impacts include the presence of heavy equipment and the stockpiling of soil. Post-construction impacts to visual quality include a moderate height increase of existing overtopping features within a heavily industrialized unit. Levee failure would result in a significant adverse impact to the aesthetics of the Central Industrial District levee unit.

4.6.9 Proposed Borrow Area

No significant visual quality impacts would occur within the proposed borrow area as a result of the proposed levee improvements. Excavating, hauling, grading, and crop cultivation already occur within the proposed borrow area. Soil borrowing would result in more intensive excavation, earth moving, and hauling than the level of these activities currently conducted within the borrow area. Short-term, construction related visual quality impacts would occur from the increased presence of heavy equipment, stockpiling of soil, and related borrow activities. Grading would occur when soil borrowing activities are complete to level the topography of the borrow area.

4.7 Soils and Prime Farmland

4.7.1 Argentine Levee Unit Alternative

No significant impacts to prime farmland are anticipated from the preferred alternative selected for the Argentine levee unit. The preferred alternative is the nominal 500-year+3 levee raise and underseepage controls. The majority of the soil landside of the Argentine levee is mapped as the Sarpy-Haynie complex, which is not classified as prime farmland by the NRCS (Zavesky and Boatwright, 1977). Haynie and Eudora are prime farmland soils located within the eastern portion of the Argentine unit within the proposed construction area. The area occupied by the existing levee, and the area adjacent to the existing levee is previously disturbed from levee construction. The approximate eastern one-third of the existing levee was constructed on prime farmland soils. The soil under the existing levee that is comprised of prime farmland will be left in place. Impacts to prime farmland from the nominal 500year+3 levee raise preferred alternative are not considered significant as the proposed construction would take place primarily within previously disturbed areas and the majority of prime farmland soil under the existing levee would be left in place. No post impacts to prime farmland would be anticipated to occur unless levee failure resulted in the loss of prime farmland to the Kansas River.

4.7.2 East Bottoms Levee Unit Alternative

No significant impacts to prime farmland are anticipated from the preferred alternative selected for the East Bottoms levee unit. The two-acre area that would be disturbed for relief well installation is mapped as urban bottomland, which is not classified as prime farmland by the NRCS. This land is previously disturbed due to construction of the levee and the Bayer facility. No impacts to prime farmland are anticipated as a result of the construction and operation of the preferred alternative due to the absence of prime farmland soils in the area of proposed construction.

A.7.3 Fairfax-Jersey Creek Board of Public Utilities Floodwall Alternative No significant impacts to prime farmland are anticipated from the preferred alternative selected for the Fairfax-Jersey Creek BPU floodwall. The preferred alternative of installing an additional row of piles and pouring a foundation slab extension would result in a minor impact to prime farmland due to the creation of impervious surface from pile and slab construction. The soil within the vicinity of the existing floodwall is mapped as Haynie silt loam, which is classified as prime farmland by the NRCS. The vicinity of the proposed construction is heavily disturbed from construction of the existing floodwall and facilities necessary for BPU to conduct energy production and water treatment processes. It is likely that prime farmland soils were excavated from the property during construction of the BPU facility and the existing soil is comprised of random fill. The area adjacent to the existing floodwall is not currently cultivated and agricultural activities will not likely occur in this area. No significant impacts to prime farmland are anticipated from the construction and operation of the preferred alternative due to the heavily disturbed nature of the area of proposed construction.

4.7.4 Fairfax-Jersey Creek Sheetpile Wall Alternative

No significant impacts to prime farmland are anticipated from the preferred alternative selected for the Fairfax-Jersey Creek sheetpile wall. The preferred alternative of installing an additional row of piles and pouring a foundation slab extension would not be anticipated result in any impacts to prime farmland soils. The location of sheetpile installation is approximately 20

feet above the normal Missouri River elevation in an area mapped as Haynie silt loam, which is classified as prime farmland by the NRCS (Zavesky and Boatwright, 1977). However, this location is extremely and extensively disturbed from the placement of fill material on top of riprap to elevate this area for access road construction. Prime farmland soils may exist under layers of random fill and rip-rap. This land is not currently used for agriculture and is not anticipated to be used for agricultural purposes. No significant impacts to prime farmland would be anticipated from the construction and operation of the preferred alternative due to the severely disturbed nature of the area within, and adjacent to the proposed construction.

4.7.5 North Kansas City Levee Unit – Harlem Alternative

No significant impacts to prime farmland are anticipated from the preferred alternative selected for the North Kansas City Harlem area. The preferred alternative is a buried collector system. Prime farmland within the area of proposed construction is Haynie silt loam, which is mapped as a linear strip of land from the bank of the Missouri River landward and downgradient of the existing levee to the fenceline. The area landward (north) of the fenceline consists of residences and businesses and is classified as urban bottomland, which is not considered prime farmland. No significant impacts to prime farmland would be anticipated from the construction and operation of the preferred alternative. This area is previously disturbed from construction of the existing levee. The area of proposed construction is likely impervious fill, which may, or not have been placed on top of existing prime farmland soils. Water that seeps through the levee would be returned to the Missouri River using portable diesel pumps. No post-construction impacts to prime farmland would be anticipated.

4.7.6 North Kansas City Levee Unit – National Starch Alternative

No significant impacts to prime farmland would be anticipated from the preferred alternative selected for the North Kansas City National Starch site. The preferred alternative for the National Starch site is the pump station construction and the installation of pressure relief wells. Proposed construction would occur on impervious surface (gravel fill) and mowed grass within a levee maintenance area that is mapped urban bottomland by the NRCS, which is not considered prime farmland. An outlet structure and conveyance path may be constructed riverside of the levee in an area Haynie silt loam, which is classified as prime farmland by the NRCS. If the conveyance path is constructed, a relatively small impact of approximately 0.37 acre would occur to prime farmland. The area of conveyance path construction is previously disturbed from levee construction and may consist of impervious fill. No significant impacts to prime farmland would be anticipated from the National Starch site preferred alternative. A small impact of 0.37 acres may occur if the conveyance path is constructed. However, this area is previously disturbed from levee construction and may not contain Haynie silt loam, the mapped prime farmland soil. No post-construction impact to prime farmland from relief well and pump station operation is anticipated.

4.7.7 Armourdale Levee Unit Raise Alternatives

No significant impacts to prime farmland would be anticipated from any of the alternatives proposed for the Armourdale unit. The tentatively preferred alternative for this unit is the nominal 500-year+3 levee raise with underseepage controls. The area adjacent to the existing levee is mapped Haynie silt loam, which is classified as prime farmland by the NRCS, and Onawa overwash, which is classified by the NRCS as prime farmland if it is drained

(Zavesky and Boatwright, 1977). The area occupied by the existing levee, and the area adjacent to the existing levee is previously disturbed from levee construction. If the mapped prime farmland soil was left in place during the construction of the existing levee, the majority of it would be left in place following construction. Some existing prime farmland would be covered with borrow soil for the earthen levee raise. Borrow soil would likely consist of prime farmland soil, which is predominantly mapped within the area of proposed borrow. This land is not currently used for agriculture and is not anticipated to be used for agricultural purposes. No significant impacts to prime farmland would be anticipated from the construction and operation of the preferred alternative due to the severely disturbed nature of the area within, and adjacent to the proposed construction.

4.7.8 Central Industrial District Levee Unit Raise Alternatives

No significant impacts to prime farmland would be anticipated from any of the alternatives proposed for the Central Industrial District levee unit. All alternatives proposed would have a relatively minor impact on prime farmland. The tentatively preferred alternative for this unit is the nominal 500-year+3 levee raise with underseepage controls. The area adjacent to the existing levee is mapped Haynie silt loam, which is classified as prime farmland by the NRCS (Zavesky and Boatwright, 1977). The area occupied by the existing levee, and the area adjacent to the existing levee is previously disturbed from levee construction. If the mapped prime farmland soil was left in place during the construction of the existing levee, the majority of it would be left in place following construction. Some existing prime farmland would be covered with borrow soil for the earthen levee raise. Borrow soil would likely consist of prime farmland soil, which is predominantly mapped within the area of proposed borrow. This land is not currently used for agriculture and is not anticipated to be used for agricultural purposes. No significant impacts to prime farmland would be anticipated from the construction and operation of the preferred alternative due to the severely disturbed nature of the area within, and adjacent to the proposed construction.

4.7.9 Proposed Borrow Area

A significant localized impact to prime farmland would be anticipated as a result of borrow activities to implement the recommended plan. The borrow area measures approximately 276 acres and about 200 of those acres are mapped prime farmland by the NRCS. These include the Haynie and Eudora soils series. Onawa overwash is mapped in the eastern portion of the proposed borrow area and is only classified as prime farmland by the NRCS if it is drained. The Sarpy-Haynie complex is the dominant soil mapped along the foreshore. Within the area of proposed borrow, a surface area of approximately sixty acres would be excavated to a depth of about ten feet to acquire the borrow soil needed to construct the recommended plan. It is unknown whether all of the soil borrowed will be mapped as prime farmland, as the location of borrow will be located where WaterOne decides to locate their next lime storage areas. Construction of the preferred alternatives would result in an adverse, localized impact to prime farmland. However, additional prime farmland is mapped throughout Wyandotte and adjacent counties.

4.8 Hazardous Waste Management

Given the industrial and commercial nature of the study area, the presence of contamination was anticipated, investigated, and addressed throughout the planning process. Relatively minor areas of either verified or potential contamination such as leaking USTs (usually associated with transportation and trucking facilities) are anticipated at various locations along the length of the levee. These sites are identified within the HTRW appendix. These UST sites are expected to have typical POL non-CERCLA type contamination. Established Corps of Engineers construction procedures have the capability to effectively address such sites. Under the recommended plan, the USTs are planned for removal, the area backfilled with clean fill, and disposal action taken for contaminated material within a suitable approved landfill. The cost estimates include cost for removal and replacement of five USTs along with appropriate contingencies.

4.8.1 Argentine Levee Unit Alternative

The HTRW appendix contains detailed information on the Argentine sites listed below. It should be noted that the HTRW appendix addresses potential contamination impacts from the perspective of the alternative(s) with the highest probability of impact to identified contaminated sites (i.e. the most extreme case). The selection of the recommended levee raise eliminated many potential impacts to the contaminated areas, as the footprint of the recommended plan in most instances is smaller than the most extreme case.

Some additional investigations are planned during PED phase for relatively minor Argentine unit properties with the potential for contamination. Testing access to some of these minor sites was not made available by the owners, and additional real estate access negotiations may be needed during PED. Should tests on these sites indicate the presence of regulated CERCLA material, then the sponsor is aware that if the site cannot be avoided, then both clean-up and the costs for any clean-up is the sponsor's responsibility.

No substantial impacts to hazardous waste are anticipated from the preferred alternative selected for the Argentine levee unit. The preferred alternative is the nominal 500-year+3 levee raise including underseepage controls.

RCRA contamination and remediation areas along the landward toe of the levee between stations 91+00 to 118+00 was the focus of avoidance measure planning as the Argentine alternatives were refined. In the recommended plan, an I-wall is used to raise the existing levee section adjacent to the contaminated area. The I-wall is located on top of the levee with sheetpile supports driven inside the levee. This approach avoids the area of contamination. Construction activities will be planned to prevent disturbance of the contamination. Access roads and work zones are planned for non-contaminated areas.

The foreshore area just north of the levee between stations 80+00 and 105+00 was originally considered as a potential borrow area, because of its close proximity. During the site evaluation process, it was determined that area should be avoided and other borrow sources be investigated. The reasons for this recommendation are 1) extensive soil testing would be required because the foreshore property is associated with a RCRA permitted facility currently undergoing soil and groundwater remediation 2) there are two SWMUs which have been

identified in this area and 3) there is the potential for borrow area activities to have an adverse impact on the ongoing groundwater cleanup.

Roadway Express and E & M Transwood Truck and Trailer Repair, currently have underground storage tanks on their property between station 160+00 and 185+00. E & M Transwood has a diesel underground storage tank pad visible from the levee. These tanks lie in the area of the planned underseepage berm and would be removed before levee construction. The underground storage tanks at Roadway Express were listed in the ERIIS database search, but could not be seen from the levee road during a site visit on the Argentine levee. Any contaminated soil would also have to be excavated and hauled to a landfill. A buried collector is planned to be constructed at Station 179+50 to 183+00, but should not impact hazardous waste.

 Property along Sta 200+00 to 225+00 has a history of groundwater contamination. The area is located outside the footprint of the recommended alternative. However, the presence of the groundwater contamination resulted in the elimination of a buried collector system in favor of a earthen filter blanket. The filter blanket is a surface feature which will not have any potential to affect contaminant plumes.

Around Station 220+00 to 245+00, large auto salvage yards are present. The surface soils may contain hydrocarbons and metals that have leaked from the salvaged vehicles. Solid waste may also be encountered in this area, especially towards the southern portion. The northernmost portion and the very southernmost portion of these yards would be covered with a landside levee raise and berm. The recommended plan was adjusted during final refinement to avoid one area of potential organic and metals contamination (not tested) associated with the auto salvage yards. The areas that comprise stations 223+00 to 227+00 and 243+00 to 245+00 are selected to have unsuitable soils removed and replaced. Trash or contaminated soil that is discovered must be excavated and disposed of in a landfill. An abandoned building is also located near Station 221+00 and should be demolished due to its location in the levee berm footprint. While no records revealed the prior use of the building, the appearance is one of a service station or autobody repair shop. Underground storage tanks may have been present and tank removal and soil excavation may be required.

The main Argentine pump station/box culvert construction near Sta 253+00 was planned in recognition of the POL contamination present in/around this area. This contaminated material is considered non-CERCLA. The contaminated material will be removed and replaced (with clean fill material) during construction of the replacement pump station. An appropriate landfill will be used for disposal of the contaminated excavated material. The cost estimate contains contingency and work area factors to cover this plan.

 During early alternative planning, the area between Sta 260+00 to 275+00 was considered for buried collector or relief well installation to improve levee raise stability. As the development of alternatives proceeded, it was recommended that measures which introduce the possibility of migration of POL contamination in this area be avoided where possible. Refinements to the recommended plan included a rock toe for levee stability in lieu of relief wells or buried collector.

4.8.2 East Bottoms Levee Unit Alternative

No significant impacts to hazardous waste would be anticipated from the preferred alternative selected for the East Bottoms unit. Groundwater contamination is known to be present within the area of proposed construction. The preferred alternative for this levee unit is the installation of pressure relief wells along the Blue River from stationing 405+00 to 420+00. This alternative provides underseepage control and avoids impacts to ongoing contamination remediation mesures and any future corrective actions. The location of the proposed relief wells is located a considerable distance west- and upgradient of known contaminant plumes. Therefore, relief wells should have no impact on the existing groundwater plumes under transient or flowing conditions, and no significant impacts to hazardous waste would be anticipated from the construction and operation of relief wells to provide underseepage control for the East Bottoms levee unit.

4.8.3 Fairfax-Jersey Creek Board of Public Utilities Floodwall Alternative No significant impacts to hazardous waste would be anticipated from the preferred alternative selected for the Fairfax-Jersey Creek BPU floodwall. The preferred alternative is to strengthen the existing floodwall with an additional row of piles and a foundation slab extension. There are no known areas of contamination within the vicinity of the existing floodwall. Therefore, no impacts to hazardous waste are anticipated from the construction or operation of the preferred alternative for the BPU floodwall.

4.8.4 Fairfax-Jersey Creek Sheetpile Wall Alternative

No significant impacts to hazardous waste would be anticipated from the preferred alternative selected for the Fairfax-Jersey Creek sheetpile wall. The preferred alternative is to install an open cell sheetpile wall landside of the existing sheetpile wall. There are no known areas of contamination within the vicinity of the existing sheetpile wall. Therefore, no impacts to hazardous waste are anticipated from the construction or operation of a new sheetpile wall.

4.8.5 North Kansas City Levee Unit – Harlem Alternative

No significant impacts to hazardous waste would be anticipated from the preferred alternative selected for the North Kansas City Harlem area. The preferred alternative is the installation of a buried collector. There are no known areas of contamination within the vicinity of the proposed construction. Therefore, no impacts to hazardous waste would be anticipated to occur from the construction and operation of a buried collector system.

4.8.6 North Kansas City Levee Unit – National Starch Alternative

No significant impacts to hazardous waste would be anticipated from the preferred alternative selected for the North Kansas City National Starch site. The preferred alternative is the installation of relief wells and pump station construction. There are no known areas of contamination within the vicinity of the proposed construction. Therefore, no impacts to hazardous waste would be anticipated to occur from the construction and operation of relief wells and a pump station.

4.8.7 Armourdale Levee Unit Raise Alternatives

All of the alternatives proposed for the Armourdale unit could potentially impact hazardous waste. No significant impacts to hazardous waste are anticipated from the tentative preferred alternative selected for the Armourdale unit. The tentative preferred alternative for this unit is the nominal 500-year+3 levee raise including underseepage controls. The Armourdale levee unit is heavily industrialized and is known to have areas of soil or groundwater contamination within the vicinity of the existing levee. Generally, as the level of protection increases, so does the amount of land required for construction and the potential to impact hazardous waste. Areas of potential concern within the footprint of the existing line of protection are discussed below.

The Proctor & Gamble Manufacturing Company (P&G) has conducted business adjacent to the Armourdale unit since 1911. An investigation of the Kansas Groundwater Monitoring Network in 1988 by KDHE found that two active monitoring wells contained concentrations of VOCs above Kansas Action Levels (KALs) and MCLs. These wells were sampled again in 1990, 1991, and 1992, and were found to have much lower concentrations. In the 1994 Site Inspection Prioritization, KDHE recommended No Further Remedial Action for the groundwater issues at these wells. In 2005, both wells were plugged. No remedial action has occurred to address the groundwater. Therefore, a plume may be present beneath this area. An HTRW Follow-Up Investigation (Hydrogeologic, 1999) lists P&G as a medium priority for RCRA Corrective Actions and is a permitted site for treatment, storage, and chemical disposal.

During a site visit by the Corps and the Kaw Valley Drainage District (KVDD) on August 12, 2005, numerous above ground storage tanks (ASTs) were observed near the property fence line. A firefighting practice area is located on the riverside of the levee and is listed as Solid Waste Management Unit (SWMU) #9 in USEPA documents. A large amount of debris and waste was dumped and buried in this area prior to the practice area construction. Two other areas of concern include a past spill into the Kansas River and the other is in proximity of the water storm sewers. Little information is known about these two sites.

Based on the groundwater data collected by KDHE, the installation of relief wells as underseepage controls should be avoided between stations 45+00 and 75+00. Since the plume has not been clearly identified, a smaller restrictive area could be established with additional investigations if relief wells are required. If construction occurs on the riverward side, the debris and dumped solid waste should be removed and replaced with suitable fill material. All waste is considered either construction or municipal waste and can be taken to a solid waste landfill. A few ASTs on the southern portion of the property may require removal and, depending on their contents, tank closure by KDHE before construction begins.

Auto salvage yards are located next to the levee toe from stations 111+00 to 116+50. The Reconnaissance Report and Follow-Up Investigation did not have any information on this site. This site was not listed as an area of concern in any of the VISTA, USEPA, or KDHE databases. These areas should be more fully investigated to ensure that the surface and subsurface soil is clean in the levee footprint.

Trimodal (a.k.a. Great Lakes Container Corporation and Container Recycling, Inc.) cleans and stores drums on site in close proximity to the levee toe. This property is listed in the

CERCLIS database as a Superfund site, but is currently listed as no further action planned. In the Follow-Up Investigation, the company was listed in many USEPA databases for LUSTs, RCRA violations, and USTs. Numerous RCRA violations were documented from 1986 to 1994. A USEPA cleanup was initiated by the USEPA in the late 1990s. This property was capped to prevent exposure to contaminants around 2001. From USEPA reports and letters, some soil contamination from lead and PCBs exists on this property. It is recommended that any type of excavation or installation of relief wells for subsurface underseepage control be avoided. If underseepage drainage is required, additional granular material could be placed over the existing gravel. Coordination with the USEPA on berm placement over the cap area is also recommended.

Midwest Cold Storage (formerly Williams Meat Company) operates a food storage facility within the Armourdale unit. The Reconnaissance Report and Follow-Up Investigation did not have any information for this property. A UST was removed from the property in 1990. During a site visit, a propane tank and transformer were observed on the landside of the levee. The area around the transformer may require further inspection before construction to ensure that PCB contamination is not present. No additional concerns were identified for this property.

PBI Gordon Corporation is located between stations 278+00 and 293+00. Ground disturbance should be avoided within this area. Soils excavated from this area may need to be tested prior to disposal. Some soil may require hazardous waste disposal. Additional groundwater investigation should be conducted prior to the expansion of the existing subsurface relief well system. ASTs would also need to be removed, which would involve soil sampling for tank closures.

4.8.8 Central Industrial District Levee Unit Raise Alternatives

Twenty preliminary sites were identified which require additional research to determine if hazardous or toxic issues at those sites would impact construction during the CID construction phase. These sites were identified because of their status as a hazardous waste generator or the presence underground storage tanks at a given site. No additional assessment was completed at any of the twenty sites yet and no conclusions can be drawn at this time whether any of the sites constitute a concern do to hazardous or toxic waste. Preliminary hazardous waste information for the CID unit was provided in the Final Report HTRW Follow-Up Investigation for the Cities of Kansas City, Missouri and Kansas, conducted by HydroGeologic, Inc (1999). The CID is known to contain hazardous waste contamination. Soil and groundwater contamination has been caused by spills of diesel fuel and fuel oil as well as by LUSTs. The Kansas City Street Division Garage (Garage) was the site of a leaking UST in 1996, which resulted in the release of about 1,350 gallons of diesel fuel onto the pavement at the site. This material entered a drainage ditch and flowed off-site. The impacted area was approximately 2- to 3-feet wide by 750-feet long by 6-inches deep. Groundwater monitoring wells were installed and sampled. Contaminants were identified in five monitoring wells. The groundwater was monitored at this site quarterly for 2 years. KDHE files for LUST facilities indicated that a leak was reported at the Garage and that the site was being monitored. KDHE records for USTs indicated that three USTs were temporarily out of service. Neighboring properties had reported UST leaks and chemical spills that had subsequently been remediated and closed by the KDHE. Additional HTRW analysis will be included in the FFR and FEIS.

4.8.9 Proposed Borrow Area

No impacts to hazardous waste would be anticipated from borrow activities required to implement the recommended plan. Exploratory soil borings and chemical analysis sampling were conducted within the proposed borrow area January 2005. Grab samples for volatile organic compounds (VOCs) and composite samples for metals, pesticides, herbicides, and semivolatile organic compounds (SVOCs) were tested. All parameters tested were below action levels. Therefore, no impacts to hazardous waste are anticipated from the borrow activities to be conducted within the proposed borrow area.

4.9 Archaeological & Historic Resources

Because of severe previous disturbances and the lack of archaeological sites or historical structures within the project area, there would be no effect on historic properties from the no action alternative or any of the alternatives proposed for the Kansas Citys' levee units. The Corps' Kansas City District Cultural Resources Program Manager (CRPM) has recommended no further investigations be conducted within the proposed project area. The Kansas State Historic Preservation Officer and the Missouri State Historic preservation officer have concurred with this recommendation. Two areas of concern regarding historic properties include the Fairfax-Jersey Creek Board of Public Utilities floodwall and the proposed borrow area.

4.9.1 Fairfax-Jersey Creek Board of Public Utilities floodwall.

The Kansas State Historic Preservation Officer has concurred with the Kansas City District CRPM that there is no need for further investigation of this portion of the project area (Appendix C). The preferred alternative consisting of strengthening the existing floodwall with an additional row of piles and a foundation slab extension would have no effect on archeological sites or historic structures within or near the project area. Two historic structures situated immediately adjacent to the project area, a pump house and water intake, will be avoided. Because of previous disturbances in project area, there is little likelihood for the existence of archeological sites.

4.9.2 Proposed Borrow Area

The Kansas State Historic Preservation Officer (SHPO) has concurred with the Kansas City District CRPM that no survey was required for the proposed borrow area and that there is no need for further investigation of this area (Appendix A). The KSHPO determined that the proposed project should have no effect on properties listed on the National Register of Historic Places, or otherwise identified in their files. Two historic human burials are located adjacent to the proposed borrow area. The burials area will be avoided during borrow activities. A minimum 300-foot buffer is required during construction activities by the SHPO to delineate the borrowing activity from the identified burials (Appendix C).

4.10 Floodplain Terrestrial Habitat

4.10.1 Argentine Levee Unit Alternative

No significant impacts to floodplain terrestrial habitat are anticipated from the preferred alternative selected for the Argentine levee unit. The preferred alternative is the nominal 500-year+3 levee raise and underseepage controls. The majority of the land adjacent to the levee is previously disturbed from construction of the existing levee. Impacts to floodplain terrestrial habitat primarily result from landside earthen levee raise and the construction of landside

seepage berms. I-wall construction on the crown of the existing levee was incorporated into the nominal 500-year+3 levee raise to avoid further land impacts. I-walls allow a vertical raise without increasing the footprint of the existing levee. All of the levee raises proposed for this unit include similar landside and riverside excavation for floodwall replacement. The majority of land disturbance from the nominal 500-year+3 preferred alternative will result from the earthen levee raise, which includes stability berm and underseepage berm construction. The land cover in the area of reliability improvements is primarily comprised of maintained grasses. Areas disturbed as a result of the Argentine levee improvements will be backfilled, graded, and seeded with brome, rye, and fescue upon the completion of construction activities. No significant impacts to floodplain terrestrial habitat are anticipated from the preferred alternative selected for the Argentine levee unit. The approximate 70-acre impact associated with this alternative would primarily occur to areas previously disturbed from construction of the existing levee in levee maintenance areas that are established with brome, fescue, and rye to maintain levee integrity and that are mowed periodically for levee maintenance and inspection. Mature trees removed to facilitate construction, if any, would be mitigated at a 2:1 ratio.

4.10.2 East Bottoms Levee Unit Alternative

No significant impacts to floodplain terrestrial habitat would be anticipated from the preferred alternative selected for the East Bottoms levee unit. The preferred alternative is the installation of pressure relief wells. Relief wells would be installed between the levee and the fence that borders the Bayer property. This area is landside and downgradient of the existing levee within the existing right-of-way, which is previously disturbed due to construction of the levee and Bayer facility. The land cover of the area is maintained grass. Land disturbance would consist of clearing two acres for well installation and manhole construction. No significant impacts to floodplain terrestrial habitat would be anticipated from the construction and operation of the preferred alternative. The location of proposed construction is previously disturbed due to construction of the existing levee. The spacing of wells, which is estimated between 80 and 300 feet would lessen the land conversion impact. The area that the well structures would occupy measures less than one acre. The area around the well structures would be backfilled, graded and seeded when construction is complete. Therefore, significant impacts to floodplain terrestrial habitat as a result of the construction and operation of relief wells are not anticipated.

A.10.3 Fairfax-Jersey Creek Board of Public Utilities Floodwall Alternative No significant impacts to terrestrial floodplain habitat are anticipated from the preferred alternative selected for the BPU floodwall. The preferred alternative selected is the installation or an additional row of piles and a foundation slab extension. The proposed construction would take place landside of the floodwall within a relatively small amount of terrestrial acreage that is dominated by fescue and mowed periodically for maintenance purposes. Although there is a a minor potential for a small amount of soil to enter the downgradient riparian areas, construction landside of the existing floodwall would provide containment for disturbed soil and construction debris. Significant impacts to floodplain terrestrial habitat are not anticipated from the construction and operation of the BPU floodwall. An area measuring approximately two acres dominated by fescue would be disturbed during construction. Disturbed areas would be seeded with brome, fescue, and rye when construction is complete.

4.10.4 Fairfax-Jersey Creek Sheetpile Wall Alternative

No significant impacts to floodplain terrestrial habitat is anticipated from the preferred alternative selected for the Fairfax-Jersey Creek sheetpile wall. The preferred alternative is the installation of an open cell sheetpile wall, which would be driven landside of the existing sheetpile wall from a crane deployed on a barge. The area of sheetpile wall installation is maintained to prevent the establishment of woody vegetation for inspection of this area to assess sheetpile wall integrity. This area is disturbed by previous access road and sheetpile wall construction, dominated by opportunistic plant species, and periodically mowed for levee and sheetpile wall inspection. The area of disturbance as a result of the proposed construction measures about 0.80 acres and would primarily impact Johnson grass, occasional sandbar willow, cocklebur, cottonwood and red mulberry saplings. No significant impacts to floodplain terrestrial habitat is anticipated due to the installation and operation of a new sheetpile wall. The temporary land disturbance to terrestrial habitat required for construction would be buffered by the contiguous riparian habitat dominated by the aforementioned species to the north of the sheetpile area. Kaw Point, which contains both riparian vegetation and NWI-mapped forested wetlands, is located to the south of the sheetpile area. The installation of a new sheetpile wall would lessen the risk of losing terrestrial habitat to the Missouri River. Grading and seeding with grass (brome, rye and fescue) would be initiated upon the completion of construction. Opportunistic plant species would become established within disturbed areas and be periodically mowed for maintenance purposes as required prior to, and after construction of the preferred alternative.

4.10.5 North Kansas City Levee Unit – Harlem

No significant impact to terrestrial habitat is anticipated from the preferred alternative selected for the North Kansas City levee unit Harlem area. The preferred alternative is the installation of a buried collector landside of the existing levee in a levee maintenance area consisting of mowed grass (brome, fescue, and rye). An approximate five-acre area would be excavated for construction. No significant impacts to floodplain terrestrial habitat is anticipated due to the construction and operation of the buried collector. After collector installation, less than one-acre of grass habitat would be converted to relief wells and manholes. The area disturbed by construction would be graded and seeded with brome, rye, and fescue upon the completion of construction. Buried collector operation consists of collecting water from the Missouri River that seeps through the levee. Collected seepwater would subsequently be discharged back into the river using portable diesel-powered pumps.

4.10.6 North Kansas City Levee Unit – National Starch Alternatives

No significant impacts to floodplain terrestrial habitat are anticipated from the preferred alternative selected for the North Kansas City National Starch site. Relief well and pump station construction would occur on impervious surface (gravel fill) and mowed grass within a levee maintenance area. An outlet structure and conveyance path may be constructed riverside of the levee in an area dominated by riparian vegetation. No significant impacts to this area are anticipated due to the preferred alternative as a short-term land disturbance of about two acres would occur during construction. After construction, disturbed areas would be graded and seeded with grasses (brome, fescue, and rye). Trees impacted along the foreshore would be replaced at a 2:1 ratio. No significant impacts to floodplain terrestrial habitat would be

anticipated to occur due to the operation of the preferred alternative. The pump station would discharge Missouri River seepwater back into the River only during high water events.

4.10.7 Armourdale Levee Unit Raise Alternatives

No significant impacts to terrestrial floodplain habitat are anticipated as a result of the preferred alternative selected for the Armourdale levee unit. All of the alternatives proposed for the Armourdale levee unit could potentially impact floodplain terrestrial habitat. The tentatively preferred alternative is nominal 500-year+3 levee raise including underseepage control measures. The majority of the existing flood protection within this unit is earthen levee. Floodwalls are located south of the W. Kansas Avenue Bridge (approximate Kansas River miles 5.4 to 5.8), and up-and downstream of the Central Avenue Bridge (approximate Kansas River miles 1.0 to 1.9). Pump plants and closure structures are located periodically along the levee unit. Based on 2001 aerial photography, a relatively wide band of riparian vegetation is located between the Kansas Avenue Bridge and the Interstate 635 Bridge, which eventually narrows into a linear stand of trees past the 18th Street Bridge. A relatively dense stand of trees is located landside of the existing levee west of the Seventh Street Bridge between approximate river miles 3.5 and 3.8. The tentatively preferred alternative consisting of the nominal 500-year+3 levee raise and underseepage controls may impact terrestrial habitat both landside and riverside of the existing levee and floodwalls. An earthen levee raise and seepage berm construction may require the placement of borrow soil land- and riverward of the existing levee and impact terrestrial habitat. Floodwall replacement could require excavation land- and riverside of the existing floodwall and impact terrestrial habitat.

4.10.8 Central Industrial District Levee Unit Raise Alternatives

All of the alternatives proposed for the Central Industrial District would potentially impact floodplain terrestrial habitat. This unit contains more floodwall, closure structures, and pump plants than the Armourdale unit. Based on 2001 aerial photography, floodwall modification or replacement would require excavation riverside and landside of the existing levee and floodwalls, and may impact riparian vegetation within the Kansas portion of the CID between approximate Kansas River miles 0.5 and 0.8, and 1.8 and 3.1. The construction of earthen levee, seepage berm, and other features could also impact riparian vegetation. Preliminary analyses have not found geotechnical or structural deficiencies within the Missouri portion of the Central Industrial District. Any work conducted along the existing line of protection would likely impact riparian vegetation, although it is relatively sparse both landside, and riverside of the existing protection.

4.10.9 Proposed Borrow Area

No significant impacts to the existing terrestrial habitat within the proposed borrow area would be anticipated to occur as a result of the implementation of the recommended plan due to the existing condition of the proposed borrow area. The vast majority of the area encompassing the proposed borrow area has been converted from native vegetation to farmland for many years. Lime residual storage periodically occurs on areas actively used for agricultural purposes. Due to the relative lack of typical terrestrial floodplain habitat consisting of riparian vegetation and/or wetlands, no significant impacts to terrestrial floodplain habitat are anticipated from the construction of the recommended plan.

4.11 Wetlands

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4.11.1 Argentine Levee Unit Alternative

No significant impacts to wetlands would be anticipated from the preferred alternative selected for the Argentine levee unit. The preferred alternative selected for the Argentine levee unit is the nominal 500-year+3 levee raise including underseepage controls. The open water area bordered with scrub-shrub and emergent wetland vegetation located on Harcros Chemicals property between stations 110+00 and 118+00 would not be directly or indirectly impacted by the nominal 500-year+3 levee raise alternative, as it is located outside of the construction footprint at a distance from the proposed construction. A linear, emergent wetland measuring approximately 0.007 acres located between the fenceline and the levee toe at station 140+00, and a linear, emergent wetland measuring approximately 0.02 acres located along the fenceline at station 155+00 would be filled for the nominal 500-year+3 levee raise. Wetland hydrology is primarily provided by runoff from the adjacent land and direct precipitation. These wetlands are relatively small and of low quality due to the establishment of cattails (Typha sp.) and reed canarygrass (*Phalaris arundinaceae*). Cattails and reed canarygrass readily colonize disturbed areas and eventually form monotypic stands, which lack plant diversity and may prevent the establishment of additional wetland plant species. No significant impacts to wetlands would occur from the construction of the preferred alternative. The wetlands impacted are relatively small and their value consists of limited wildlife habitat. To replace the acreage and value of the impacted wetlands, a mitigation ratio of 1.5:1 as suggested by the USFWS in their Draft Coordination Act Report would result in the creation of 0.21 acres of wetland that would be planted with diverse wetland vegetation such as sedges (Carex), smartweed (Polygonum) or other wetland vegetation to provide increased habitat diversity relative to the impacted wetlands. Additionally, due to the location of the existing wetlands at far landside area of the levee toe, these wetlands could recover from the placement of borrow soil. The soil of the existing wetlands would not be excavated for use in the created wetlands as the seed banks of the existing wetlands contain not so desirable plant species. Wetland impacts would occur during construction. No wetland impacts are anticipated from the operation of the nominal 500-year+3 levee raise and underseepage controls.

4.11.2 East Bottoms Levee Unit Alternative

No impacts to wetlands would be anticipated from the preferred alternative selected for the East Bottoms levee unit. The preferred alternative is the installation of relief wells for underseepage control. No wetlands are located within, or adjacent to the area of proposed construction. Therefore, no impacts to wetlands are anticipated as a result of relief well construction or operation.

4.11.3 Fairfax-Jersey Creek Board of Public Utilities Floodwall Alternative No impacts to wetlands would be anticipated from the preferred alternative selected for the BPU floodwall. The preferred alternative is the construction of an additional row of piles and a foundation slab extension to strengthen the existing floodwall. NWI-mapped wetlands within the vicinity of the proposed construction consist of two forested wetlands measuring 5.32 and 0.30 acres that are located riverside and downgradient of the most western and eastern portions of the existing floodwall. No significant impacts to wetlands would be anticipated from the construction or operation of the BPU floodwall. The proposed construction would take place landside (behind) the existing floodwall, which would provide containment for soil and debris during construction. Best management practices and the use of temporary erosion control

measures would be used during construction to avoid potential impacts to the resources located downgradient of the existing floodwall. Wetland hydrology is not anticipated to be impacted by construction or operation of the floodwall. Therefore, no direct or indirect impacts to these wetlands would be anticipated from the construction and operation of the preferred alternative.

4.11.4 Fairfax-Jersey Creek Sheetpile Wall Alternative

No wetland impacts are anticipated from the preferred alternative selected for the Fairfax-Jersey Creek sheetpile wall. The preferred alternative is the installation of an open cell sheetpile wall landside of the existing sheetpile wall. There are no wetlands located within the vicinity of the proposed construction. Therefore, no impacts to wetlands would be anticipated from the construction or operation of the Fairfax-Jersey Creek sheetpile wall.

4.11.5 North Kansas City Unit – Harlem

No wetland impacts are anticipated from the preferred alternative selected for the North Kansas City unit Harlem area. The preferred alternative is the installation of a buried collector system. There are no wetlands located within the vicinity of the proposed construction. Therefore, no impacts to wetlands would be anticipated from the construction or operation of the buried collector system.

4.11.6 North Kansas City Unit – National Starch Alternative

No wetland impacts are anticipated from the preferred alternative selected for the North Kansas City National Starch site. The preferred alternative is the installation of relief wells and a pump station. There are no wetlands located within the vicinity of the proposed construction. Therefore, no impacts to wetlands would be anticipated from the construction or operation of the Fairfax-Jersey Creek sheetpile wall.

4.11.7 Armourdale Levee Unit Raise Alternatives

No significant wetland impacts are anticipated from the levee raise alternatives proposed for the Armourdale levee unit. The tentative preferred alternative is the nominal 500-year+3 levee raise and underseepage controls. Wetlands located adjacent to the existing line of protection in this unit are mapped by the National Wetlands Inventory north of the West Kansas Avenue Bridge at a distance from the existing line of protection within riparian vegetation. These wetlands appear to have been created from borrow activities within the foreshore. All of the alternatives proposed for this unit could cause minor impacts to existing wetland habitat due to excavation for floodwall replacement and the construction of underseepage controls and soil placement for earthen berm construction. Excavation or soil placement riverside of the existing levee and floodwalls would occur at a distance of approximately seventy-five feet from the levee toe and would not likely encroach into existing wetlands. I-walls and landside retaining walls are proposed to minimize levee encroachment into adjacent habitat. Indirect impacts could occur due to soil placement. The boundaries of any wetlands potentially impacted by the recommended plan would be delineated and the impacts would be mitigated for functions lost. Wetland delineation and impact assessment would be conducted prior to the release of the final feasibility report. Wetland impacts would be mitigated.

4.11.8 Central Industrial District Levee Unit Raise Alternatives

No significant wetland impacts are anticipated from the levee raise alternatives proposed for the CID levee unit. The tentative preferred alternative is the nominal 500-year+3 levee raise and underseepage controls. Wetlands within the CID unit located adjacent to the existing line of protection are mapped by the National Wetlands Inventory on the right bank of the Kansas River between the Interstate 70 Bridge and the James Street Bridge between approximate river miles 0.4 and 0.6, and at the confluence of the Kansas and Missouri Rivers. All of the alternatives proposed for this unit could cause minor impacts to existing wetland habitat due to excavation for floodwall replacement and the construction of underseepage controls, and soil placement for earthen berm construction, which would occur up to about fifty feet from the levee toe, and would not likely encroach into existing wetlands. Landside retaining walls are proposed to minimize levee encroachment into adjacent habitat. Indirect impacts could occur due the inadvertent introduction of soil into existing wetlands. The boundaries of any wetlands potentially impacted by the recommended plan would be delineated and the functions lost would be replaced through mitigation. Wetland delineation and impact assessment would be conducted prior to the release of the final feasibility report. Wetland impacts would be mitigated.

4.11.9 Proposed Borrow Area

A farmed wetland measuring about 0.17 acres is located within the proposed borrow area. The exact location of borrow activities is undetermined and will depend upon the location of excavation for lime storage on the WaterOne property during construction. This wetland would be excavated, or otherwise impacted by borrow activities. As suggested by the USFWS in their Draft Coordination Act Report, this wetland would be mitigated at a 1:1 ratio. The wetland created for mitigation purposed would be designed to replace the functions lost due to impacts.

4.12 Fisheries

No direct impacts to fish or other aquatic organisms would be anticipated to occur from the construction of the recommended plan. All of the proposed preferred alternatives have the potential to cause short-term, temporary construction impacts to fish and other aquatic organisms due to the inadvertent loss of a small amount of soil or sediment into an adjacent waterway. Borrow soil used for the levee raise would be free of contaminants. For all alternatives proposed, stormwater pollution measures would be in compliance with the requirements of the National Pollutant Discharge Elimination System permit. Temporary erosion control mechanisms such as silt fencing and staked straw bales would be utilized to divert flow from exposed soils, temporarily store flows, or otherwise minimize erosion and sediment runoff from construction areas. Protecting adjacent riparian and wetland habitats from sediment deposition and the introduction of construction debris would minimize or avoid the introduction of such materials into these resources and the adjacent waterway. Disturbed areas would be backfilled, graded, and seeded with brome, fescue, and rye as soon as practicable after the completion of construction activities. To further minimize impacts to water quality, and fish and other aquatic organisms, equipment would be operated to minimize the loss of soil, petroleum products, or other deleterious material into the waterway. Disturbed areas would be graded and seeded with grass (brome, rye, and fescue) when construction is complete. The presence of HTRW was extensively studied to determine the nature and location of potential contamination. Hazardous waste was avoided to the extent practicable to implement the recommended plan.

4.12.1 Argentine Levee Unit Alternative

No significant impacts to fish or other aquatic organisms would be anticipated from the preferred alternative selected for the Argentine levee unit. The preferred alternative is the nominal 500-year+3 levee raise including underseepage controls. The majority of land disturbance from the nominal 500-year+3 preferred alternative would result from earthen levee raise, stability berm, underseepage berm construction, and floodwall replacement, which would require intensive excavation and backfilling of soil. I-wall construction on the crown of the existing levee, landside retaining walls, and floodwalls were incorporated into the preferred alternative to reduce land encroachment. Although riverside excavation would be required for floodwall replacement, this activity would be conducted at a distance away from the Kansas River and no work would be conducted within the river.

Although the Argentine unit has known areas of contamination, the selection of the preferred alternative eliminated many potential impacts to contaminated areas because the construction footprint is smaller than the nominal 500-year+5 alternative. Many documented locations of contamination were avoided and the risk of encountering contamination was minimized during the planning phase through the selection of underseepage controls. This unit has been extensively studied to determine the nature and extent of contamination from hazardous waste. Hazardous waste is discussed in section 4.8. The excavation and proper disposal of contaminated soil, trash, storage tanks, or other hazardous waste containers or media would be conducted before or during construction. Temporary erosion control measures and Best Management Practices as mentioned above would be used to avoid the introduction of contaminated material into waterways and terrestrial habitat. No significant impacts to fish and other aquatic organisms would be anticipated to occur from the construction and operation of the preferred alternative selected for the Argentine unit. Land disturbance would be minimized to the practicable extent and soil and construction material would be contained to prevent their introduction into the Kansas River. The encroachment into known areas of contamination were avoided, or otherwise minimized. Known and unknown contaminated soil and media would be removed before or during construction.

4.12.2 East Bottoms Levee Unit Alternative

No significant impacts to fish or other aquatic organisms would be anticipated from the preferred alternative selected for the East Bottoms levee unit. The preferred alternative is the installation of relief wells. The location of relief well installation is landside and downgradient of the existing levee, which would provide the containment of soil and construction debris and avoid the incidental introduction of this material into the Blue and Missouri Rivers. No work would be conducted within the rivers. Known groundwater contamination is located downriver of the area of proposed construction. The installation of relief wells would not facilitate the introduction of soil or groundwater contamination into the Blue or Missouri Rivers. This alternative provides underseepage control and avoids impacts to ongoing contamination remediation measures and any future corrective actions. The location of the proposed relief wells is located a considerable distance west- and upgradient of the known contaminant plumes. Relief wells are not anticipated to impact the existing groundwater plumes under transient or flowing conditions. No significant impacts to fish or other aquatic organisms would be anticipated from the preferred alternative selected for the East Bottoms levee unit. Containment of soil and construction debris during construction would be primarily provided by the location

of relief well installation landside and downgradient of the existing levee, and groundwater contamination would not be anticipated to be impacted by relief well operation.

Missouri River.

A.12.3 Fairfax-Jersey Creek Board of Public Utilities Floodwall Alternative
No significant impacts to fish or other aquatic organisms would be anticipated from the
preferred alternative selected for the Fairfax-Jersey Creek BPU floodwall. The preferred
alternative is to strengthen the existing sheetpile wall with an additional row of piles and a
foundation slab extension. The location of the proposed construction is landside (behind) the
existing floodwall, which would provide containment for sediment and debris during
construction. Therefore, there is a low potential for soil or construction debris to enter the
Missouri River. There are no known areas of hazardous waste contamination within the vicinity
of the existing floodwall. No significant impacts to fish or other aquatic organisms would be
anticipated from the construction proposed to strengthen the floodwall, or the operation of the
floodwall after construction. The construction disturbance would be limited to the area landside
of the existing floodwall which would provide containment for excavated and borrowed soil, and

no contamination is known to occur within the vicinity of the proposed construction that would

need to be excavated prior to, or during construction. No work would be conducted within the

4.12.4 Fairfax-Jersey Creek Sheetpile Wall Alternative

No significant impacts to fish or other aquatic organisms would be anticipated from the preferred alternative selected for the Fairfax-Jersey Creek sheetpile wall. The preferred alternative is to install a new open cell sheetpile wall. The sheetpile wall would be driven landside of the existing sheetpile by a crane from the river. The proposed construction would impact an area of about 0.80 acres dominated by terrestrial vegetation. The vegetated slope landside of the existing sheetpile wall likely provides minimal organic input into the Missouri River from this area, as a low amount of leaf litter and debris would be available from the slope vegetation. No shading of the river is provided from this vegetation. As discussed in section 4.12, a small amount of soil may enter the Missouri River during construction and cause a localized and temporary increase in turbidity. Voids and disturbed areas would be graded and seeded when construction is complete. There are no known areas of hazardous waste or contamination within the vicinity of the existing sheetpile wall. No significant impacts to fish or other organisms would be anticipated to occur from the construction or operation of the preferred alternative. Construction would primarily terrestrial vegetation and water quality would not be significantly impacted by the inadvertent introduction of uncontaminated soil into the river. A new sheetpile wall would prevent the river bank from sloughing into the river.

4.12.5 North Kansas City Levee Unit – Harlem Alternative

No significant impacts to fish or other aquatic organisms would be anticipated from the preferred alternative selected for the North Kansas City Harlem area. The preferred alternative is the installation of a buried collector. The location of buried collector installation is landside and downgradient of the existing levee, which would contain disturbed and borrow soil and prevent it from entering the Missouri River. The buried collector would operate only during flood events. Water from the Missouri River that seeps through the levee would be collected and pumped back into the Missouri River using portable diesel pumps. No hazardous waste contamination is known to occur within or adjacent to the area of the proposed construction, and no work would

be conducted within the Missouri River. Due to the location of the proposed construction landside and downgradient of the existing levee and the absence of hazardous waste contamination, no significant impacts to fish or other aquatic organisms are anticipated from buried collector installation or operation.

4.12.6 North Kansas City Unit – National Starch Alternative

No significant impacts to fish or other aquatic organisms would be anticipated from the preferred alternative selected for the National Starch site. The preferred alternative is the installation of pressure relief wells and the construction of a pump station landside and downgradient of the existing levee, which would help prevent soil and construction debris from entering the Missouri River. An outlet structure may be constructed riverside at the toe of the levee and a conveyance path may be excavated to allow pumped seep water to reenter the river. The conveyance path would be lined with rock to protect the bank from eroding and headcutting towards the levee. This path, if constructed, would extend for a distance of about 100 feet riverside of the levee at a distance away from the Missouri River. After construction, the relief well system would collect river water that seeps through the levee during flood events and discharge it back over the levee into the Missouri River. Water quality would not be adversely impacted from this process. There is no known hazardous waste contamination within the vicinity of the proposed construction. No significant impacts to fish or other aquatic organisms are anticipated as a result of the operation or construction of the preferred alternative. Construction would be downgradient of the existing levee in an area of no known contamination.

4.12.7 Armourdale Levee Unit Raise Alternatives

No significant impacts to fish or other aquatic organisms would be anticipated as a result of any of the alternatives proposed for the Armourdale unit. All of the proposed levee raises would require a landside earthen levee raise, floodwall modification or replacement, I-wall installation, pump station modification or replacement, and relief wells or a buried collector system to relieve underseepage pressure. The tentatively selected preferred alternative for Armourdale is the 500year+3 levee raise. Construction of earthen levee and berms would be conducted primarily on top or landside of the existing levee. Levee and berm construction would require excavation and the placement of borrow soil. Underseepage controls would be constructed landside of the existing levee. No work is proposed to be conducted within the Kansas River. The Armourdale unit is heavily industrialized and soil or groundwater contamination is known to occur within the vicinity of the existing levee. Hazardous waste and contaminated areas would be avoided to the extent practicable. All contaminated material and hazardous waste storage vessels known to occur within the levee footprint or encountered during construction would be removed and transported to an appropriate landfill. No significant impacts to fish or other aquatic organisms would be anticipated from the construction and operation of the preferred alternative. Excavation and borrow placement would be conducted at a distance away from the Kansas River. Hazardous waste and contaminated areas would be avoided to the maximum extent. Levee failure would significantly impact fish and other aquatic organisms within and downstream of the Armourdale levee unit.

4.12.8 Central Industrial District Levee Unit Raise Alternatives

No significant impacts to fish or other aquatic organisms would be anticipated as a result of any of the alternatives proposed for the Central Industrial District levee unit. All of the

proposed levee raises would require a landside earthen levee raise, floodwall modification or replacement, I-wall installation, pump station modification or replacement, and relief wells or a buried collector system to relieve underseepage pressure. The tentatively selected preferred alternative for CID is the 500year+3 levee raise. Construction of earthen levee and berms would be conducted primarily on top or landside of the existing levee. Levee and berm construction would require excavation and the placement of borrow soil. Underseepage controls would be constructed landside of the existing levee. No work is proposed to be conducted within the Kansas River. This unit is heavily industrialized and soil or groundwater contamination is known to occur within the vicinity of the existing levee. Hazardous waste and contaminated areas would be avoided to the extent practicable. All contaminated material and hazardous waste storage vessels known to occur within the levee footprint or encountered during construction would be removed and transported to an appropriate landfill. No significant impacts to fish or other aquatic organisms would be anticipated from the construction and operation of the preferred alternative. Excavation and borrow placement would be conducted at a distance away from the Kansas River. Hazardous waste and contaminated areas would be avoided to the maximum extent.

4.12.9 Proposed Borrow Area

No significant impacts to fish or other aquatic organisms are anticipated due to proposed borrow area activities. Borrow soil would be excavated landward of the foreshore within the northern portion of the proposed borrow area to avoid or otherwise minimize impacts to the foreshore and water quality. Soil would not be borrowed from lime storage areas. No hazardous waste is known to occur within the proposed borrow area.

4.13 Wildlife

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4.13.1 Argentine Unit Alternative

No significant impacts to wildlife are anticipated from the preferred alternative selected for the Argentine levee unit. The preferred alternative is the nominal 500-year+3 levee raise and underseepage controls. The majority of land disturbance from the nominal 500-year+3 preferred alternative (about 70 acres) would result from the earthen levee raise, which includes stability berm and underseepage berm construction. The areas of proposed improvements are primarily located from the levee crown to the toe, and comprised of maintained grasses including fescue, brome, and perennial rye. As discussed in section 4.1.11.1, two linear, emergent wetlands measuring 0.02 and 0.007 will be directly impacted. The study area is dominated by urbantolerant wildlife species. Construction of the preferred alternative is anticipated to cause a temporary disturbance due to the presence of heavy equipment, and the noise and dust associated with construction. The preferred alternative avoids impacts to the large area of riparian woodland (approximately 185-acres) riverward of the existing levee, which provides abundant habitat for wildlife and would buffer the effects of the construction activities. Mature trees removed to facilitate construction would be mitigated at a 2:1 ratio. Operation of the preferred alternative would not be anticipated to significantly impact wildlife, as the operation of pumps to return seepwater to the Kansas River would only occur during flood events.

4.13.2 East Bottoms Levee Unit Alternative

No significant impacts to wildlife are anticipated from the preferred alternative selected for the East Bottoms levee unit. The preferred alternative is the installation of pressure relief

wells. The area of proposed well installation is located in a maintained grassy area between the existing levee and the Bayer property fence line. The two acres of land disturbance required for well installation would be backfilled, graded and seeded with brome, rye, and fescue upon completion of construction activities. No wetland or water quality impacts are associated with the implementation of the preferred alternative. No significant impacts to wildlife are anticipated from the construction and operation of relief wells. Impacts to wildlife habitat consist of a temporary construction impact to convert less than one-quarter acre of maintained grass to relief wells and manholes. Operation would occur only during high water events.

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4.13.3 Fairfax-Jersey Creek Board of Public Utilities Floodwall Alternative No significant impacts to wildlife are anticipated from the preferred alternative selected for the Fairfax-Jersey Creek BPU floodwall. The preferred alternative is the installation of an additional row of piles and a foundation slab extension to strengthen the existing wall. The proposed construction would take place landside of the existing floodwall within a relatively small amount of terrestrial acreage that is dominated by fescue and mowed periodically for maintenance purposes. This area provides limited opportunities for the nesting and foraging of birds and mammals and likely serves as a loafing area for few common wildlife species. The area of land disturbance would be backfilled, graded, and seeded upon completion of construction. No significant impacts to wildlife are anticipated from the construction and operation of the preferred alternative. A temporary land disturbance of about two acres would be required to convert a relatively small portion of lawn to impermeable surface. The wildlife habitat landside and downgradient of the existing floodwall is comprised of riparian vegetation (cottonwood, willows, box elder, goldenrod, and others) and two forested wetlands measuring 5.32 and 0.30 acres are National Wetlands Inventory-mapped downgradient of the western- and eastern-most portions of the existing floodwall. The availability of these habitat types would buffer the temporary land disturbance of floodwall construction.

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4.13.4 Fairfax-Jersey Creek Sheetpile Wall Alternative

No significant impacts to wildlife are anticipated from the preferred alternative selected for the Fairfax-Jersey Creek sheetpile wall. The preferred alternative is the installation of an open cell sheetpile wall, which would be driven landside of the existing sheetpile wall from a crane deployed on a barge. The area of sheetpile wall installation is disturbed by previous access road and sheetpile wall construction and is maintained to prevent the establishment of woody vegetation for inspection of this area to assess sheetpile wall integrity. The area of proposed construction measures about 0.80 acres and would primarily impact Johnson grass, and occasional sandbar willow, cocklebur, cottonwood and red mulberry saplings. This area is likely predominantly used by common birds and small mammals. No significant impacts to wildlife are anticipated as a result of the construction and operation of the sheetpile wall. Land disturbance would be buffered by the contiguous riparian habitat dominate by the aforementioned species to the north of the existing sheetpile wall. Kaw Point, which contains borth riparian vegetation and forested wetlands mapped by the NWI is located south of the existing sheetpile wall. Grading and seeding of disturbed areas with grass (brome, fescue, rye) would be completed after construction. No wetlands would be impacted by the construction and operation of the preferred alternative.

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4.13.5 North Kansas City Levee Unit – Harlem

 No significant impacts to wildlife are anticipated from the preferred alternative selected for the North Kansas City Harlem area. The preferred alternative is the installation of a buried collector. The buried collector would be constructed landside and downgradient of the existing levee in a levee maintenance area comprised of brome, fescue, and rye that is likely minimally used be wildlife. A temporary construction disturbance would occur as an approximate 5-acre area would be excavated for collector installation. No significant impacts to wildlife are anticipated from the construction and operation of the preferred alternative. Less than one-quarter acre of mowed grass would be converted to pumping manhole structures. The spacing of manholes, and the grading and seeding of areas in between manholes after the temporary construction disturbance, would lessen the land conversion impact to wildlife. No wetland impacts are associated with the preferred alternative. The operation of the buried collector would occur only during high water events when portable diesel pumps would be used to return Missouri River seepwater back into the River. The operation of pumps would cause a short-term, temporary disturbance to wildlife.

4.13.6 North Kansas City Levee Unit – National Starch Alternative

No significant impacts to wildlife are anticipated from the preferred alternative selected for the North Kansas City levee unit National Starch site. The preferred alternative is the construction of relief wells and a pump station. The land disturbance required for the proposed construction measures about two acres and is located primarily on gravel fill, and secondarily, on mowed grass within a levee maintenance area landside and upgradient of the existing levee. This habitat has a relatively low value to wildlife. An outlet structure and conveyance path may be constructed for seepwater drainage. Mature trees impacted, if any, would be replaced at a 2:1 ratio. No wetlands are located within or adjacent to the area of proposed construction. No significant impacts to wildlife are anticipated from the construction or operation of the preferred alternative. The existing habitat is of relatively low value to wildlife. After the temporary construction disturbance, the disturbed areas would be backfilled, graded, and seeded with brome, rye, and fescue. The operation of the relief wells and pump station would occur only during high water events and cause a temporary, short-term disturbance to wildlife.

4.13.7 Armourdale Levee Unit Raise Alternatives

All of the alternatives proposed for the Armourdale levee unit could adversely impact wildlife. The tentatively preferred alternative is the nominal 500-year+3 levee raise and underseepage controls. Wildlife habitat within this unit adjacent to the existing flood protection primarily consists of riparian habitat riverside of the existing levee and floodwalls. Wetlands are mapped by the National Wetlands Inventory north of the West Kansas Avenue Bridge within the riparian vegetation. No significant impacts to wildlife are anticipated from the construction and operation of the tentatively preferred alternative. Construction would occur primarily landside of the existing protection on ground previously disturbed by construction and maintained for levee inspection. An earthen levee raise and seepage berm construction would require the placement of borrow soil primarily landward of the existing levee and impact a small acreage of wildlife habitat. Floodwall replacement could require excavation land- and riverside of the existing levee an impact a small acreage of wildlife habitat. The use of I-walls and retaining walls will decrease the amount of floodplain encroachment in some areas as a smaller construction footprint is needed for these features compared to an earthen levee raise. Construction

disturbance would be temporary. The existing resources along the foreshore including riparian vegetation and NWI-mapped wetlands would buffer the construction disturbance. Impacts to these resources would be mitigated. The operation of the levee post construction is not anticipated to cause substantial impacts to wildlife.

4.13.8 Central Industrial District Levee Unit Raise Alternatives

All of the alternatives proposed for the CID levee unit could adversely impact wildlife. The tentatively preferred alternative for the CID unit is the nominal 500-year+3 levee raise and underseepage controls. No significant impacts to wildlife are anticipated from the construction and operation of the tentatively preferred alternative. Wildlife habitat within this unit adjacent to the existing flood protection primarily consists of riparian habitat. Wetlands are mapped by the National Wetlands Inventory on the right bank of the Kansas River between the Interstate 70 Bridge and the James Street Bridge between approximate river miles 0.4 and 0.6, and at the confluence of the Kansas and Missouri Rivers. Similar to the Armourdale unit, construction would occur primarily landside of the existing protection on ground previously disturbed by construction and maintained for levee inspection. An earthen levee raise and seepage berm construction would require the placement of borrow soil primarily landward of the existing levee and impact a small acreage of wildlife habitat. Floodwall replacement could require excavation land- and riverside of the existing levee an impact a small acreage of wildlife habitat. The use of I-walls will decrease the amount of floodplain encroachment in some areas as a smaller construction footprint is needed for these features compared to an earthen levee raise. Construction disturbance would be temporary. The existing resources along the foreshore including riparian vegetation and NWI-mapped wetlands would buffer the construction disturbance. Impacts to these resources would be mitigated. The operation of the levee post construction is not anticipated to cause substantial impacts to wildlife.

4.13.9 Proposed Borrow Area

No significant impacts to wildlife are anticipated from the alternatives proposed. Current land use of the proposed borrow area consists of residual lime storage and row-cropping. There is a low amount of riparian habitat located within the proposed borrow area. Borrow soil would not be excavated from the riparian area located north of the proposed borrow area. The exact location of soil removal within the borrow area is undetermined. It is presumed that a 0.17 acre farmed wetland located within the borrow area would be excavated or otherwise impacted by borrow activities. Impacts to this wetland will be mitigated. Mature trees impacted, if any, by borrow activities would be replaced. Therefore, no substantial changes to the composition of wildlife that currently uses the proposed borrow area would be anticipated to occur under the recommended plan.

4.14 Threatened and Endangered Species

4.14.1 Argentine Levee Unit Alternative

No significant impacts to threatened and endangered species would be anticipated to occur from the preferred alternative selected for the Argentine levee unit. The preferred alternative is the nominal 500-year+3 levee raise and underseepage controls. The proposed construction is primarily located in areas maintained for levee inspection and dominated by grasses (fescue, brome, and perennial rye). Two small, emergent wetlands dominated by cattails, curly dock, and reed canarygrass will be filled as discussed in section 4.11.1. A small number of

individual trees such as cottonwood, box elder, red mulberry, or other opportunistic species may be impacted by project requirements. It is unlikely that Federally-listed species reported to occur within the vicinity of the project area by the USFWS use the wetland habitat that would be filled. The piping plover and least tern utilize unvegetated wetlands, sandbars and mudflats. Of the species reported to occur within the study area by the USFWS, the bald eagle may incidentally occur within the vicinity of the Argentine levee unit due to the availability of riparian vegetation. The bald eagle could be indirectly impacted if perching or roosting is disrupted by construction. The vast majority of work would be conducted from the existing levee crown landward towards the adjacent properties. No construction would occur within the Argentine foreshore and construction impacts from preferred alternative construction would be temporary. The migratory pallid sturgeon may incidentally occur adjacent to the study area within the Kansas River. Levee unit operation is not anticipated to significantly impact pallid sturgeon or any Federal threatened and endangered species. Levee failure could result in the release of sediment and industrial chemicals onto the Argentine foreshore and into adjacent receiving waters.

4.14.2 East Bottoms Levee Unit Alternative

No impacts to Federally-listed threatened and endangered species would be anticipated from the preferred alternative selected for the East Bottoms unit. The preferred alternative is relief well installation. Relief wells would be installed between the levee and the fence that borders the Bayer property, which consists of mowed grass (brome, fescue, and rye) within the existing right-of-way. The USFWS has not documented this location or associated habitat as being used by the threatened and endangered species reported to occur within the vicinity of the project area. Due to its migratory nature, the pallid sturgeon may incidentally occur within the Missouri River adjacent to the area of proposed construction. Relief well construction and operation is not anticipated to significantly impact pallid sturgeon or any Federal threatened and endangered species. Federal threatened and endangered species are not anticipated to be impacted since they do not inhabit the habitat types that would be impacted and the pallid sturgeon is not known to occur within the Blue River.

A.14.3 Fairfax-Jersey Creek Board of Public Utilities Floodwall Alternative No impacts to Federally-listed threatened and endangered species would be anticipated from the preferred alternative selected for the Fairfax-Jersey Creek BPU floodwall. The preferred alternative is the strengthening of the existing floodwall by constructing an additional row of piles and a foundation slab extension. Construction would be conducted landside (behind) of the existing floodwall within grasses primarily dominated by fescue. Construction behind the existing floodwall would provide the containment of soil and construction debris. This location and associated habitat are not documented as a location or habitat type that is used by the threatened and endangered species reported to occur within the project area by the USFWS. Due to its migratory nature, the pallid sturgeon may incidentally occur within the Missouri River adjacent to the area of proposed construction. No significant impacts to water resources or water quality are anticipated from construction or floodwall operation.

4.14.4 Fairfax-Jersey Creek Sheetpile Wall Alternative

No impacts to federally threatened and endangered species would be anticipated from the preferred alternative selected for the Fairfax-Jersey Creek sheetpile wall. The preferred alternative is to install an open cell sheetpile wall landside of the existing sheetpile wall. As

described in section 4.10.4 this location is a levee maintenance area that is periodically cleared for inspection. Habitat in the vicinity of the existing sheetpile wall is primarily Johnson grass with occasional sandbar willow, cocklebur, cottonwood and red mulberry saplings. No impacts to Federally threatened and endangered species would be anticipated from the construction or operation of the sheetpile wall. This location and associated habitat are not documented as a location or habitat type that is used by the threatened and endangered species reported to exist in the study area by the USFWS. Due to its migratory nature, the pallid sturgeon may incidentally occur within the Missouri River adjacent to the area of proposed construction. No significant impacts to water resources or water quality would be anticipated from construction or sheetpile wall operation. A new sheetpile wall would stabilize the existing bank and prevent the sloughing of the bank into the river.

4.14.5 North Kansas City Levee Unit – Harlem Alternative

No impacts to Federal threatened or endangered species would be anticipated from the preferred alternative selected for the North Kansas City levee unit Harlem area. The preferred alternative is the construction of a buried collector, which would be installed landside and downgradient of the existing levee in a levee maintenance are dominated by grasses (brome, fescue, and rye). This location and associated habitat are not documented as a location or habitat type that is utilized by the threatened and endangered species reported to occur within the project area by the USFWS. Due to its migratory nature, the pallid sturgeon may incidentally occur within the Missouri River adjacent to the area of proposed construction. No significant impacts to water resources or water quality would be anticipated from the construction or operation of the preferred alternative. The operation of portable diesel pumps would be temporary as the pumps would return Missouri River seepwater back into the River only during flood events.

4.14.6 North Kansas City Unit – National Starch Alternative

No impacts to Federal threatened or endangered species would be anticipated from the preferred alternative selected for the North Kansas City levee unit National Starch site. The preferred alternative is the construction of a relief well and pump station landward of the existing levee on the National Starch property, which consists of gravel fill and some mowed grass within a levee maintenance area. The bald eagle and pallid sturgeon are considered the only threatened and endangered species with the potential to occur within the area of proposed construction based on habitat availability. However, this location and associated habitat are not documented as a location or habitat type that is utilized by the threatened and endangered species reported to occur within the project area by the USFWS. Although the bald eagle is not documented to nest or roost within the riparian habitat located riverward of the proposed construction, indirect impacts could occur if a conveyance path is constructed to convey collected Missouri River seepwater back into the River and to prevent headcutting towards the levee. The path could require the excavation of up to about 0.37 acres of riparian vegetation. The pallid sturgeon may incidentally occur within the Missouri River adjacent to the proposed construction. The pump station would cause a short-term disturbance as they would only operate during flood events. No significant impacts to water resources and water quality are anticipated from relief well and pump station operation. Levee failure could result in the release of a variety of manufacturing chemicals into the waterway.

4.14.7 Armourdale Levee Unit Raise Alternatives

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No impacts to Federal threatened and endangered species are anticipated as a result of any of the levee raise alternatives proposed for the Armourdale levee unit. The preferred alternative selected for this unit is the nominal 500-year+3 levee raise and underseepage controls. The wetlands mapped by the National Wetlands Inventory within this unit have not been delineated. However, they are unlikely to be viable habitat to the piping plover and interior least tern. The bald eagle and pallid sturgeon are considered the only Federal threatened and endangered species with the potential to occur within the area of proposed construction based on habitat availability. Bald eagle habitat consists of the riparian vegetation located adjacent to the existing levee and floodwalls. No bald eagle roosting or nesting has been documented within the Armourdale levee unit. Although it is unlikely, the migratory pallid sturgeon may incidentally occur within the Kansas River adjacent to the proposed construction. No significant impacts to Federal threatened and endangered species would be anticipated from the construction and operation of the preferred alternative. No significant impacts to water resources and water quality would be anticipated. Impacts to wetlands and mature riparian vegetation would be mitigated. Levee failure could result in a variety of debris and chemicals entering the Kansas River.

4.14.8 Central Industrial District Unit Levee Raise Alternatives

No impacts to Federal threatened and endangered species are anticipated as a result of any of the levee raise alternatives proposed for the Central Industrial District levee unit. The preferred alternative selected for this unit is the nominal 500-year+3 levee raise and underseepage controls. The wetlands mapped by the National Wetlands Inventory within this unit have not been delineated. However, they are unlikely to be viable habitat to the piping plover and interior least tern. The bald eagle and pallid sturgeon are considered the only Federal threatened and endangered species with the potential to occur within the area of proposed construction based on habitat availability. Bald eagle habitat consists of the riparian vegetation located adjacent to the existing levee and floodwalls. No bald eagle roosting or nesting has been documented within the CID levee unit. Although it is unlikely, the migratory pallid sturgeon may incidentally occur within the Kansas River adjacent to the proposed construction. No significant impacts to Federal threatened and endangered species would be anticipated from the construction and operation of the preferred alternative. No significant impacts to water resources and water quality would be anticipated. Impacts to wetlands and mature riparian vegetation would be mitigated. Levee failure could result in a variety of debris and chemicals entering the Kansas River.

4.14.9 Proposed Borrow Area

No impacts to Federally-listed threatened and endangered species would be anticipated as a result of borrow activities. The bald eagle and pallid sturgeon are the only threatened and endangered species with the potential to occur within the area of proposed borrow due to habitat availability. No bald eagle roosting or nesting has been documented within the riparian vegetation within, or adjacent to the proposed borrow area. Project requirements would not impact riparian the foreshore riparian vegetation adjacent to the proposed borrow area. The migratory pallid sturgeon may incidentally occur within the Kansas River adjacent to the proposed borrow area.

4.15 Environmental Justice Overview

The Executive Order on Environmental Justice (12898) requires consideration of social equity issues, particularly any potential disproportionate impacts to minority or low-income groups. This is to ensure that issues such as culture and dietary differences are taken into consideration to ensure that adequate risk is evaluated (USEPA, 2003). The USEPA Region VII provided a map of potential Environmental Justice areas within the project area for preliminary analysis (Figure 4-1). To determine potential impacts to minority or low-income groups, the racial and income composition of the individual census tracts within, and adjacent to the study area, were examined using 2000 census data (http://factfinder.census.gov/home).

For Census 2000, the Office of Management and Budget (OMB) considered race and Hispanic origin to be separate and distinct concepts, and the terms "Hispanic" and "Latino" synonymous for reporting purposes. The OMB defines Hispanic or Latino as "a person of Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture or origin regardless of race." Therefore, Hispanics/Latinos may be of any race and are not defined as an individual race category by the OMB. Persons who reported Hispanic/Latino origin are included within the seven mutually exclusive race categories used by the OMB to sum the total population, which include: (1) White; (2) Black or African American; (3) American Indian & Alaska Native; (4) Asian; (5) Native Hawaiian and Other Pacific Islander; (6) Some other race; (7) Two or more races.

Table 4-1 represents the racial composition, including the percentage of persons who reported Hispanic or Latino origin, of the individual levee units in comparison to the closest zip code(s) in which it resides. Comparison data provides insight into the demographics of an area overall while providing an understanding of areas that are often overlooked in general population data. The percentages of persons who reported "some other race" and "two or more races" were combined, and are represented in the "Other Races" column. Racial composition and Hispanic or Latino origin percentages were calculated from the census tract population data reported in section 3.4.

Table 4-1. Levee Unit Racial Composition and Hispanic/Latino Origin

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Levee Unit Zip Code(s)	% Minority	White (%)	Black or African American (%)	American Indian & Alaskan Native (%)	Asian (%)	Native Hawaiian & Other Pacific Islander (%)	¹ Other Races (%)	Hispanic or Latino Origin (%)
Argentine	45.9	54.1	20.1	0.7	1.3	0.1	23.3	37.1
66106	22.5	77.5	7.7	0.9	1.3	0.0	12.5	19.3
Armourdale	40.5	59.5	1.3	1.6	1.3	0.0	36.2	75.0
66105	40.5	59.5	1.3	1.6	1.3	0.0	36.3	50.6
Birmingham	6.5	93.5	1.6	0.7	0.6	0.1	3.5	4.6
64161	3.0	97.0	0.5	0.2	0.0	0.0	2.3	0.2
CID: MO-KS	23.3	76.7	18.6	0.6	0.7	0.2	3.1	2.1
64101, 64102 64105, 66118	21.2	78.8	25.9	0.6	0.9	0.2	4.2	4.2
East Bottoms	35.2	64.8	9.6	0.7	16.8	0.4	7.7	10.8
64106, 64120	42.4	57.6	27.1	0.9	6.9	0.2	7.3	9.6
² Fairfax-Jersey Creek	0.0	100.0	0.0	0.0	0.0	0.0	0.0	100.0
66115	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0
North Kansas City	18	82.0	4.7	0.7	4.1	0.2	8.3	8.3
64116	13.2	86.8	3.5	0.5	4.1	0.1	4.8	5.8

Source: Census 2000

 The majority of persons within the study area reported their race as "white". The Argentine and Armourdale units have the highest minority populations within the study area, and are represented by residents of Hispanic or Latino origin. These units also reported the highest percentages of residents of some other race, or two or more races. The Argentine unit reported the highest percentage of Black or African American residents followed by the CID-Missouri and Kansas unit, and East Bottoms unit. The East Bottoms reported the highest percentage of Asian residents, followed by North Kansas City. The North Kansas City, Birmingham, and Fairfax-Jersey Creek units reported the highest percentage of white residents per levee unit. Although the Fairfax-Jersey Creek unit is comprised of a white population of Hispanic or Latino origin, only one person reported to reside in this levee unit.

The core of Executive Order 12898 provides for the protection of both minority and low-income groups. Therefore, income data from section 3.3 and racial composition data from Table 4-2 were used to provide an overview of each levee unit in regards to their respective minority and income level composition. Poverty is measured as individuals with an annual income of \$12,500. The Office of Management and Budget's Statistical Policy Directive 14, the Census Bureau uses a set of money income thresholds that vary by family size and composition to determine who is poor. If a family's income is less than that family's threshold, then that family, and every individual in it, is considered poor.

¹Percentages are calculated from the sum of persons who reported "some other race" and "two or more races".

²Only one person reported to reside in the Fairfax-Jersey Creek levee unit area.

Table 4-2. Levee Unit Minority Residents and Residents Living Below Poverty

Levee Unit	¹ Minority Residents (%)	Residents Living Below Poverty (%)
Argentine	45.9	26.4
Armourdale	40.5	35.2
Birmingham	6.5	6.1
CID: MO-KS	23.3	9.3
East Bottoms	35.2	27.5
² Fairfax-Jersey Creek	0.0	NA
North Kansas City	18	12.2

4133 Source: Census 2000

NA—Information Not Available

Additional Environmental Justice Indicators

Additional environmental justice indicators such as education level, languages spoken, and percent children and elderly reveal trends about the socio-demographic aspects of a community that may be used to make generalizations about the population and the capacity of residents to cope with potential additional environmental stresses.

The level of education and/or literacy rates for the adult population provides a critical measure of the likelihood and the ability of the community to know about and participate in public meetings, to comment on written proposals and to otherwise participate in the decision-making process. If tools used to encourage public participation are not tailored to local education rates, or perceived rates, the outreach process may be ineffectual (USEPA, 2004). There are generally no significant differences between the education levels of the residents within the levee units, and the education levels of residents within the counties of respective levee units (USEPA, 2005).

Language Distribution

Information on whether languages other than English are spoken among the population, and percentage distribution of these languages, is important in determining effective public participation processes. Below is a table depicting the percent persons residing within a zip code and respective levee unit and the percent of persons who speak another language other than English at home.

¹Includes residents who reported "Other Races" as described in Table 4-1.

²Only one person reported to reside in the Fairfax-Jersey Creek levee unit area.

Table 4-3. Levee Unit Language Distribution

Levee Unit / Zip Code	% English	% Spanish	% Asian / Pacific Island	% Indo- European
Argentine / 66106	83.6	14.0	1.5	0.8
Armourdale / 66105	57.7	40.1	1.8	0.4
Birmingham / 64161	96.8	3.2	0.0	0.0
CID: MO-KS / 64101, 64102, 64105, 66118 (combined tabulation for all zip codes)	93.3	4.5	3.1	4.4
East Bottoms / 64106, 64120 (combined tabulation for all zip codes)	80.3	11.1	8.7	3.1
² Fairfax-Jersey Creek / 66115	NA	NA	NA	NA
North Kansas City / 64116	87.8	4.7	2.3	4.2
Jackson County, MO	92.4	4.4	1.1	1.7
Wyandotte County, KS	84.4	12.7	1.4	1.2

Source: U.S. Census Bureau, 2000

According to the U.S. Census Bureau (2000), the most common language spoken at home, by individuals age five and over, is English with an average of 71.3% combined among all levee units. Spanish is the second language other than English that is spoken in the area with an average of 11%. Residents residing in zip code 66105 (Armourdale) rate the highest population of Hispanic or Latino ethnicity and the highest Spanish-speaking. Additionally, there is a small percentage of persons residing in the levee units that speak an Asian or Pacific Island language as the most common language spoken at home, an average of 1.8% combined among all levee units.

Sensitive Populations

Children under age five and elderly populations above age 65 are considered to be sensitive populations that may experience disproportionate impacts from environmental stressors. The table below provides insight into a subpopulation that exists within the study area in comparison to County averages. Generalizations conclude that zip code 66105 has the highest percent of children under age five and the zip code 64106 and 64120 combined account for the highest percent of residents age 65 and over.

Table 4-4. Levee Unit Sensitive Populations

Levee Unit / Zip Code	Children under age 5 (%)	Elderly over age 65 (%)	
Argentine / 66106	8.6%	11.2%	
Armourdale / 66105	10.7%	7.9%	
Birmingham / 64161	4.9%	10.5%	
CID: MO-KS / 64101, 64102, 64105, 66118	2.1%	5.2%	
East Bottoms / 64106, 64120	7.5%	13.9%	
² Fairfax-Jersey Creek / 66115	0	0	
North Kansas City / 64116	6.1%	13.5%	
Jackson County, MO	7%	12.5%	
Wyandotte County, KS	8.1%	11.7%	

Source: U.S. Census Bureau, 2000

Data and associated information used for the consideration of environmental justice was reviewed by Region VII of the U.S. Environmental Protection Agency. Given the demographic characteristics of the project area, expanded public involvement through enhanced public communication will be utilized to communicate the levee unit improvements. A list of environmental justice contacts within the project area provided by the USEPA will be used to ensure that project components will be communicated to residents who might not otherwise become aware of the project through standard methods such as public meetings and notice of availability published in the Federal Register and local newspapers.

Community Cohesion

A cohesive community can be described as a community comprised of people from different backgrounds and/or circumstances that have similar life opportunities, where positively valued diversity and a sense of belonging build strong and positive relationships between people in the workplace, in schools, and within neighborhoods. In regards to this civil works project, community cohesion is examined to determine if a change in the physical environment could potentially disrupt the continuity and quality of life within a community.

Maintaining the cohesion of existing communities within the study area is primarily dependent upon improving the current level of flood damage reduction protection and maintaining existing land use. As described in section 3.3, the project area is largely developed, with the industrial workforce primarily supported by commuters, and full time/long-term residents located in a variety of locations relative to the existing levee units. Industry and associated commuters are interested in the continued use of the land for business and commerce. Established residents require the continued use of the land for permanent residency. As stated in section 3.3.8 (Study Area General Trends in Population, Household and Employment) MARC forecast data indicates a steady increase in total employment, and steady/modest growth regarding population and the number of households within the seven levee units. This forecast includes the consideration of the current level of flood protection provided by the existing levee system.

4.16 Socioeconomic Impacts Including Environmental Justice, Community Cohesion, and Induced Damages

4.16.1 Argentine Levee Unit Alternative

Construction of the Argentine preferred alternative would contribute to the long-term stability of the protected area. Six minor structures (outbuildings) would be located to facilitate levee improvements. There would be no impacts to the Wyandotte County tax base or the Kaw Valley Drainage District tax base due to demolition or removal of structures. With the increased levee unit reliability and performance, existing businesses would be expected to continue their existing occupancy in the Unit and new businesses and investment would be more easily attracted to the Unit in the future if vacancies occur, resulting in a stronger tax base. With continued industrial and commercial stability enhanced by the increased reliability against flooding, existing neighborhoods and populations would also be expected to remain relatively stable, barring impacts from other sources. Construction of the Argentine preferred alternative would also be expected to temporarily increase employment in the Unit. In the short term, the temporary presence of construction workers for the project may bring a temporary increase in demand for some services in the local area, but also a temporary increase in business, profits, and sales tax receipts at the local retail and service establishments. It is expected that the community service base is adequate to accommodate temporary construction workers without significant changes. Public health and safety would also be enhanced by the preferred alternative and its increased reliability against flooding. All required construction access will be by public roadway or already established levee access. Accessibility to individual businesses in the Argentine Unit would not be expected to be impacted by construction of the preferred alternative. Overall, accessibility to the levee unit areas would remain the same, but there would likely be some increased road use and increased traffic, dust, and noise during the construction period. These effects would be local and temporary, and are not expected to be significant.

from major flood events. In the short term, in the absence of flooding, the local economy, tax base, population, and employment would be expected to remain relatively stable. However, once major flooding occurred in the Unit, long terms effects under the no action alternative could include diminishing economic stability, business interruptions that would likely jeopardize workers jobs and wages, potential losses in population and employment, and reductions in the tax base based on businesses relocating and diminished property values due to more frequent flood damage. There are also significant concerns about public health and safety, and the potential for loss of life, under the no action alternative. The no action alternative would leave one of the busiest rail yards in the nation vulnerable and with a major flood event could halt or at least significantly impede the nationwide movement of goods by rail. A major north-south interstate highway that runs through the Unit could also be shut down. Major national production centers and wholesale distribution and containerized shipping centers in the Unit

Under the no action alternative, the Argentine Unit would remain vulnerable to flooding

Compared to the other levee units, Argentine has a relatively high percentage of minority residents (45.9%), residents living below poverty (26.4%), children under the age of five (8.6%), and elderly residents over the age of sixty-five (11.2%). Argentine levee unit improvements

would close during flooding, with major impacts to the local and regional economy and with

potential to impact the broader national economy at least on a short term basis.

would be constructed primarily adjacent to industry and are not anticipated to cause any disproportionate impacts to minority or low-income groups.

Induced damages as a result of project requirements are discussed in section 4.16.10.

Implementation of the preferred alternative is not anticipated to disrupt the continuity and quality of life within a community. Levee improvements would improve the flood damage reduction protection provided to the businesses and residences within the Argentine levee unit protected area. Upon completion of the levee improvement, the community cohesion may increase, as levee improvements would provide a safer living environment.

Minority, low-income residents, and sensitive populations would be negatively affected by levee failure as a result of the no action alternative. However, no disproportionate impacts to minority or low-income groups are anticipated to occur as a result of implementing the no action alternative. In the absence of a Federal action addressing levee improvements, property damage, short and long-term unemployment as a result of levee failure would depend upon the nature and extent of damages to residences and businesses.

The community cohesion of residential areas could be adversely impacted by the no action alternative. Depending upon its location relative to residences and businesses, an overtopping event could adversely affect the cohesion of a community. A levee failure would result in significant impacts to community cohesion as a result of potential fatalities and the displacement of residents and business closures.

4.16.2 East Bottoms Levee Unit Alternative

Construction of the East Bottoms preferred alternative would help ensure the long-term stability of the protected area. With increased levee unit reliability against flooding, existing businesses would be expected to continue their existing occupancy and new businesses and investment would be more easily attracted in the event of future vacancies. The alternative would not require acquisition or relocation of any structures, residents or businesses, and thus no impacts to the tax base would be expected due to construction of the preferred alternative. During construction, a temporary increase in employment in the unit would be expected. The area service base is adequate to accommodate temporary construction workers without significant changes. Construction access will be by public roadway or already established levee access. In the short term there could be a short temporary impact to a railroad spur. There will

also likely be some temporary increased road use and traffic, dust and noise during construction.

Implementation of the preferred alternative is not anticipated to cause any disproportionate impacts to minority or low-income groups. Relief well installation is a very localized and isolated improvement that would be conducted adjacent to industry.

Implementation of the preferred alternative is not anticipated to disrupt the continuity and quality of life within any communities. Benefits to community cohesion as a result of relief well installation may be realized. Increasing the effectiveness of the flood damage reduction mechanism facilitates the safety and continued employment of Bayer personnel by minimizing the potential for structural damage as a result of underseepage and potential levee failure.

The no action alternative would continue the study area's exposure to the threat of flooding by the Missouri River if the levee fails. The East Bottoms Unit has both residential occupants and a thriving industrial and commercial base. The businesses provide many jobs for lower income residents who live in the area and for workers residing outside the Unit in the Greater Kansas City Metropolitan Area. Major rail yards and mainline tracks would be flooded in the event of levee failure with a major flood event, potentially impacting the movement of goods and services nationwide. A north-south interstate highway running through the Unit could also be shut down. A major electric utility plant that provides service to the Greater Kansas City area, specifically on the Missouri side, and major national industries and production facilities located in the unit would be impacted and shut down. Flooding would cause business interruptions that could jeopardize workers' wages and salaries, and could seriously harm continued viability of the existing business and industry base. The local tax base would be impacted with business losses, business interruptions, and potential permanent relocation of major businesses. With little advance warning and failure of the levee, residents would lose homes and possessions, and could have difficulty finding and relocating to other affordable housing. Public safety and health, and the potential for loss of life, would be significant issues under the no action alternative.

No disproportionate impacts to minority or low income groups are anticipated to occur as a result of implementing the no action alternative. In the absence of a Federal action addressing levee seepage, work stoppages as a result of catastrophic levee failure, would be dependent upon the nature and extent of damages. The cohesiveness of the levee protected area work environment could be negatively affected if no action is taken to address the underseepage problem. Infrastructure damage or levee failure as a result no Federal action could result in work stoppages. No impacts to the community cohesion of a residential area is anticipated due to the location of the proposed construction adjacent to industry and away from residences.

 4.16.3 Fairfax-Jersey Creek Board of Public Utilities Floodwall Alternative Construction of the Fairfax-Jersey Creek BPU Floodwall preferred alternative would help ensure the long-term viability and stability of the major national, regional and local businesses and industries in the Fairfax Industrial Area. With increased levee unit reliability against flooding, existing businesses would be expected to continue their existing occupancy and new businesses and investment would be more easily attracted in the event of future vacancies. The alternative would not require acquisition or relocation of any structures or businesses, and thus no impacts to the tax base would be expected due to construction of the preferred alternative. During construction a temporary increase in employment in the unit could be expected. The area service base is adequate to accommodate temporary construction workers without significant changes. Construction access will be by public roadway or already established levee access. There may be a temporary impact to a railroad spur, and some temporary increased road use and traffic, dust, and noise would be expected in the immediate area of construction.

Short-term construction noise may be experienced by the apartment complex located south of Esplanade Street and the Union Pacific Railroad trackage within the 66115 zip code, about 0.3 miles south of the area of proposed construction. No construction-or post construction impacts to community cohesion are anticipated as a result of floodwall modifications.

The no action alternative would continue the unit's exposure to flooding based on the threat of floodwall failure during a major flood event, and subsequent flooding throughout the unit. The Fairfax-Jersey Creek Unit has an extremely large and thriving industrial and commercial base. The industries and businesses provide many jobs for Kansas City residents who live in and around the metropolitan area. A major auto manufacturing facility, the sole production site in the nation for a certain model of automobile, a utility plant that provides service on the Kansas side of the Greater Kansas City area, and other major national industries and production facilities would be impacted and potentially shut down. Flooding would cause business interruptions that could jeopardize workers' wages and salaries, and could seriously harm continued viability of the existing business and industry base. Under the no action alternative and with a major flood event the local tax base is at risk of being impacted by business losses, business interruptions, and potential permanent relocation of major businesses. With little advance warning and failure of the floodwall during a major flood event, public safety and health issues, and potential for loss of life, could be significant under the no action alternative.

No disproportionate impacts to minority or low-income groups are anticipated to occur as a result of implementing the no action alternative. Work stoppages due to inundation as a result of floodwall failure would be dependent on the nature and extent of damages. In the absence of a Federal action, the cohesion of the levee protected area work environment could be compromised by high water and potential floodwall failure. No impacts to the community cohesion of a residential area are anticipated due to the location of the proposed construction adjacent to industry and not in proximity to residences.

4.16.4 Fairfax-Jersey Creek Sheetpile Wall Alternative

Construction of the Fairfax-Jersey Creek Sheetpilewall preferred alternative would help ensure the long-term viability and stability of the major national, regional and local businesses and industries in the Fairfax Industrial Area. With increased levee unit reliability against flooding, existing businesses would be expected to continue their existing occupancy and new businesses and investment would be more easily attracted in the event of future vacancies. The alternative would not require acquisition or relocation of any structures or businesses, and thus no impacts to the tax base would be expected due to construction of the preferred alternative. During construction a temporary increase in employment in the unit would be expected. The area service base is adequate to accommodate temporary construction workers without significant changes. Construction access will be by public roadway or already established levee access. In the short term there may be a short, temporary impact to a railroad spur, and some temporary increased road use and traffic, dust, and noise would likely be expected in the immediate area of construction.

Implementation of the preferred alternative would be conducted adjacent to the river and industry. Sheetpile installation is not anticipated to cause any disproportionate impacts to minority or low-income groups. Implementation of the preferred alternative is not anticipated to disrupt the continuity and quality of life within a community. Sheetpile wall construction would improve the flood damage reduction protection provided to the residents and businesses inside of the Fairfax- Jersey Creek protected area.

The no action alternative would continue the unit's exposure to flooding based on the threat of floodwall failure during a major flood event, and subsequent flooding throughout the unit. The Fairfax-Jersey Creek Unit has an extremely large and thriving industrial and commercial base. The industries and businesses provide many jobs for Kansas City residents who live in and around the metropolitan area. A major auto manufacturing facility, the sole production site in the nation for a certain model of automobile, a utility plant that provides service on the Kansas side of the Greater Kansas City area, and other major national industries and production facilities would be impacted and shut down. Flooding would cause business interruptions that could jeopardize workers' wages and salaries, and could seriously harm continued viability of the existing business and industry base. Under the no action alternative and with a major flood event, the local tax base is at risk of being impacted by business losses, business interruptions, and potential permanent relocation of major businesses. With little advance warning and failure of the floodwall during a major flood event, public safety and health issues, and potential for loss of life, could be significant under the no action alternative.

The sheetpile wall location is located adjacent to the river and industry. Implementation of the no action alternative is not anticipated to cause any disproportionate impacts to minority or low-income groups. No impacts to community cohesion are anticipated as a result of the no action alternative, as no communities are located within or adjacent to the area of proposed construction.

4.16.5 North Kansas City Levee Unit – Harlem Alternative

Construction of the North Kansas City-Harlem preferred alternative would help ensure the long-term stability of the protected area. With increased levee unit reliability against flooding, existing businesses and industries would be expected to continue their existing occupancy and new businesses and investment would be more easily attracted in the event of future vacancies. The many residents in the unit would continue to benefit from the jobs and the amenities offered by a stable and viable community. The preferred alternative would not require acquisition or relocation of any structures, residents or businesses, and thus no impacts to the tax base would be expected due to construction of the preferred alternative. During construction, a temporary increase in employment in the unit would be expected. The area service base is adequate to accommodate temporary construction workers without significant changes. Construction access will be by public roadway or already established levee access; however in the short term some temporary increased road use and traffic, dust and noise during construction would likely be expected.

Construction of a buried collector system will improve interior drainage for the adjacent community, including minority and low-income residents. Income and population data from 1999 indicates that the area adjacent to the proposed construction is not generally comprised of a minority population, or a population living at, or below poverty level (Census 2000). However, it is likely that some adjacent residents are either minorities, or persons living at or below the poverty level, or a combination thereof. It is not anticipated that buried collector installation will cause any disproportionate impacts to minority or low-income groups. A buried collector system is designed to pump water that seeps through the levee back over the levee during high water events.

Implementation of the preferred alternative is not anticipated to disrupt the continuity and quality of life within adjacent communities. A buried collector system would reduce the flooding risk of the adjacent communities.

The North Kansas City-Harlem no action alternative would leave the entire North Kansas City Unit vulnerable to flooding with a major flood event and levee failure at the Harlem site. The North Kansas City Unit protects major residential, commercial and industrial development in the City of North Kansas City, Missouri. The Downtown Airport and major rail yards and mainline tracks would be impacted and shut down during major flood events, levee failure, and subsequent flooding of the Unit. The general movement and distribution of goods and commodities would be impacted, not only because of rail shutdown, but also because North Kansas City has major warehouse facility development that would be flooded. Railroad tracks in the North Kansas City Unit are also heavily used for shipment of coal to powerplant facilities in the region, and thus electric service in the Kansas City area and in other areas in the region could be interrupted. Major large industries and businesses that provide many jobs in the Unit would be flooded, and would temporarily shut down in the short term. Workers salaries and wages would be interrupted in the short term, and many jobs would be lost in the long term. There would be negative impacts to local tax bases in the long term under the no action alternative because without a levee solution and with subsequent and repeated flooding during major flood events, property values would decrease, and residents, businesses and industries would eventually move out of the Unit.

 Minority and low-income residents reside within the vicinity of Levee Road. Overtopping or levee failure would adversely affect a variety of races and income levels. No disproportionate impacts to minority or low-income groups are anticipated as a result of the no action alternative. Overtopping or levee failure as a result of the no action alternative would significantly impact the quality of life and cohesion of adjacent communities.

4.16.6 North Kansas City Levee Unit – National Starch Alternative Construction of the North Kansas City-National Starch preferred alternative would help ensure the long-term stability of the protected area. With increased levee unit reliability against flooding, existing businesses and industries would be expected to continue their existing occupancy and new businesses and investment would be more easily attracted in the event of future vacancies. The many residents in the unit would continue to benefit from the jobs and the amenities offered by a stable and viable community. The preferred alternative would not require acquisition or relocation of any structures, residents or businesses, and thus no impacts to the tax base would be expected due to construction of the preferred alternative. During construction, a temporary increase in employment in the unit would be expected. The area service base is adequate to accommodate temporary construction workers without significant changes. Construction access will be by public roadway or already established levee access; however in the short term some temporary increased road use and traffic, dust and noise during construction would likely be expected.

Implementation of the preferred alternative is not anticipated to cause any disproportionate impacts to minority or low-income groups. Relief well installation is a

localized improvement that would be conducted adjacent to industry. Implementation of the preferred alternative is not anticipated to disrupt the continuity and quality of life within a community. Benefits to community cohesion as a result of relief well installation may be realized. Increasing the effectiveness of the flood damage reduction mechanism facilitates the safety and continued employment of National Starch personnel by minimizing the potential for levee overtopping and underseepage failure.

The North Kansas City-National Starch no action alternative would leave the entire North Kansas City Unit vulnerable to flooding with a major flood event and levee failure at the Harlem site. The North Kansas City Unit protects major residential, commercial and industrial development in the City of North Kansas City, Missouri. The Downtown Airport and major rail yards and mainline tracks would be impacted and shut down during major flood events, levee failure, and subsequent flooding of the Unit. The general movement and distribution of goods and commodities would be impacted, not only because of rail shutdown, but also because North Kansas City has major warehouse facility development that would be flooded. Railroad tracks in the North Kansas City Unit are also heavily used for shipment of coal to powerplant facilities in the region, and thus electric service in the Kansas City area and in other areas in the region could be interrupted. Major large industries and businesses that provide many jobs in the Unit would be flooded, and would temporarily shut down in the short term. Workers salaries and wages would be interrupted in the short term, and many jobs would be lost in the long term. There would be negative impacts to local tax bases in the long term under the no action alternative because without a levee solution and with subsequent and repeated flooding during major storm events, property values would decrease, and residents, businesses and industries would eventually move out of the Unit.

No disproportionate impacts to minority or low-income groups are anticipated to occur from the no action alternative. No residential areas are located within the vicinity of proposed construction. In the absence of a Federal action addressing levee underseepage, work stoppages at the National Starch facility as a result of infrastructure or foundation damage, or catastrophic levee failure, would be dependent upon the nature and extent of damages. The cohesiveness of the National Starch work environment could be negatively affected if no action is taken to address the underseepage problem at this facility. Infrastructure damage or levee failure as a result no Federal action could result in work stoppages. No impacts to the community cohesion of a residential area are anticipated due to the location of the proposed construction adjacent to industry and away from residences.

4.16.7 Armourdale Levee Unit Raise Alternatives

Construction of the Armourdale preferred alternative would contribute to the long-term stability of the protected area. The project would likely not require acquisition or relocation of any structures, residents or businesses. Impacts to the Wyandotte County tax base or the Kaw Valley Drainage District tax base due to demolition or removal of structures are not expected. With the increased levee unit reliability and performance, existing businesses would be expected to continue their existing occupancy in the Unit and new businesses and investment would be more easily attracted to the Unit in the future if vacancies occur, resulting in a stronger tax base. With continued industrial and commercial stability enhanced by the increased reliability against flooding, existing neighborhoods and populations would also be expected to remain relatively

stable, barring impacts from other sources. Construction of the Armourdale preferred alternative would also be expected to temporarily increase employment in the Unit. In the short term, the temporary presence of construction workers for the project may bring a temporary increase in demand for some services in the local area, but also a temporary increase in business, profits, and sales tax receipts at the local retail and service establishments. It is expected that the community service base is adequate to accommodate temporary construction workers without significant changes. Public health and safety would also be enhanced by the preferred alternative and its increased reliability against flooding. All required construction access will be by public roadway or already established levee access. Accessibility to individual businesses in the Armourdale Unit would not be expected to be impacted by construction of the preferred alternative. Overall, accessibility to the levee unit areas would remain the same, but there would likely be some increased road use and increased traffic, dust, and noise during the construction period. These effects would be local and temporary, and are not expected to be significant. Implementation of the preferred alternative is not anticipated to result in disproportionate impacts to minority or low income groups, or substantially disrupt the continuity and quality of life within a community. It provides equitable levels of protection among the Kansas River units, is temporary in nature and flooding impacts are very rare in occurrence.

Under the no action alternative, the Armourdale Unit would remain vulnerable to flooding from major flood events. In the short term, in the absence of flooding, the local economy, tax base, population, and employment would be expected to remain relatively stable. However, once major flooding occurred in the Unit, long terms effects under the no action alternative could include diminishing economic stability, business interruptions that would likely jeopardize workers jobs and wages, potential losses in population and employment, and reductions in the tax base based on businesses relocating and diminished property values due to more frequent flood damage. There are also significant concerns about public health and safety, and the potential for loss of life, under the no action alternative. The no action alternative would leave a major rail yard and mainline tracks vulnerable and with a major flood event could halt or at least significantly impede the nationwide movement of goods by rail. Closure of a Board of Public Utilities facility during flooding would impact public health and safety. Major national production centers and distribution centers would be impacted during flooding, with major affect on the local and regional economy and with potential to impact the broader national economy at least on a short term basis.

Induced damages within, or adjacent to the Armourdale levee unit could occur as a result of any of the Argentine levee improvements proposed. These induced damages are discussed below in section 4.16.10. Upon completion of the levee improvements for the Kansas units, community cohesion may increase as levee improvements would provide a safer living environment.

The no action alternative would result in no improvements to the Armourdale levee unit. In the absence of improving the flood damage reduction reliability of the Armourdale unit, impacts would occur to people irregardless of race or income, and community cohesion would be compromised. Property damage and short, and long-term unemployment as a result of levee failure would depend upon the nature and extent of damages to residences and businesses. Levee

failure could result in significant impacts to community cohesion as a result of potential fatalities and the displacement of residents and business closures.

Potential induced damages in the Armourdale unit result from the rare flood events and flood stages that occur above the existing top of levee elevations in these units, and would be incurred beginning with about a 300 year, or more rare, event.

4.16.8 Central Industrial District Levee Unit Raise Alternatives

Construction of the CID preferred alternative would contribute to the long-term stability of the protected area. The project would not be anticipated to require acquisition or relocation of structures, residents or businesses. Impacts to the Wyandotte County, Kansas and Jackson County, Missouri tax bases or the Kaw Valley Drainage District tax base due to demolition or removal of structures are not expected. With the increased levee unit reliability and performance, existing businesses would be expected to continue their existing occupancy in the Unit and new businesses and investment would be more easily attracted to the Unit in the future if vacancies occur, resulting in a stronger tax base. With continued stability enhanced by the increased reliability against flooding, the small residential population in the loft areas would also be expected to remain relatively stable, barring impacts from other sources. Construction of the CID Preferred Alternative would also be expected to temporarily increase employment in the Unit. In the short term, the temporary presence of construction workers for the project may bring a temporary increase in demand for some services in the local area, but also a temporary increase in business, profits, and sales tax receipts at the local retail and service establishments. It is expected that the community service base is adequate to accommodate temporary construction workers without significant changes. Public health and safety would also be enhanced by the preferred alternative and its increased reliability against flooding. All required construction access will be by public roadway or already established levee access. Accessibility to individual businesses in the CID Unit would not be expected to be impacted by construction of the preferred alternative. Overall, accessibility to the levee unit area would remain the same, but there would likely be some increased road use and increased traffic, dust, and noise during the construction period. These effects would be local and temporary, and are not expected to be significant. Implementation of the preferred alternative is not anticipated to result in disproportionate impacts to minority or low income groups, or substantially disrupt the continuity and quality of life within a community. It provides equitable levels of protection among the Kansas River levee districts, is temporary in nature and flooding impacts are very rare in occurrence.

Under the no action alternative, the CID Unit would remain vulnerable to flooding from major flood events. In the short term, in the absence of flooding, the local economy, tax base, population, and employment would be expected to remain relatively stable. However, once major flooding occurred in the Unit, long terms effects under the no action alternative could include diminishing economic stability, business interruptions that would likely jeopardize workers jobs and wages, potential losses in the current small residential population and in employment in the CID Unit. Reductions in the tax base based on businesses potentially relocating and on diminished property values due to more frequent flood damage would also likely occur. There are also significant concerns about public health and safety, and the potential for loss of life, under the no action alternative. The no action alternative would leave mainline

railroad tracks vulnerable and with a major flood event could halt or at least significantly impede the nationwide movement of goods by rail. Kemper Arena, the American Royal Building, and other CID businesses, including headquarters for a major national manufacturing company, would close during flooding causing potentially major impacts to the local and regional economy.

Induced damages within, or adjacent to the CID levee unit could occur as a result of any of the Argentine levee improvements proposed. These induced damages are discussed below in section 4.16.10. Upon completion of the levee improvements for the Kansas units, community cohesion may increase as levee improvements would provide a safer living environment.

The no action alternative would result in no improvements to the CID unit. In the absence of improving the flood damage reduction reliability of the Armourdale unit, impacts would occur to people irregardless of race or income, and community cohesion would be compromised. Property damage and short, and long-term unemployment as a result of levee failure would depend upon the nature and extent of damages to residences and businesses. Levee failure could result in significant impacts to community cohesion as a result of potential fatalities and the displacement of residents and business closures.

Potential induced damages in the CID unit result from the rare flood events and flood stages that occur above the existing top of levee elevations in these units, and would be incurred beginning with about a 300 year, or more rare, event.

4.16.9 Proposed Borrow Area

 No significant socioeconomic impacts, disproportionate impacts to minority or low-income residents, or significant impacts to the quality of life and cohesion of adjacent communities are expected from borrow activity as a result of the recommended plan.

4.16.10 Induced Damages

 Implementation of the three Argentine raise alternatives, including the proposed nominal 500-year+3 preferred alternative, would temporarily increase the potential for induced physical flood damages in the Armourdale and Central Industrial District levee units and in low-lying unleveed areas just upstream of Argentine and just upstream and across from Armourdale if certain very rare flood events were to occur (Table 4-5). The potential damages in the Armourdale and CID units are deemed temporary in nature because they could occur only in the interim period between completion of the Argentine levee unit raise and before construction is completed for similar raises for the Armourdale and CID units. Evaluation of raise alternatives for the Armourdale and CID units will be completed for the Kansas Citys final report.

 Table 4-5. *Argentine Raise Induced Damages

	Argentine	Annual Induced Physical Damages			
Alternative	Unit Annual Benefits	Armourdale Unit (Temporary)	CID Unit (Temporary)	Upstream Areas	Total
Argentine Nominal 500+0 Raise	\$15,652,600	\$160,600	\$24,600	\$2,100	\$196,400
Argentine Nominal 500+3 Raise	\$17,637,800	\$171,700	\$27,400	\$2,600	\$210,800
Argentine Nominal 500+5 Raise	\$18,635,500	\$175,200	\$27,800	\$2,900	\$215,000
Argentine No Levee Raise, Just Pump Station Remedies and Earthwork	\$13,443,000	\$0	\$0	\$0	\$0

^{*(}October 2004 Prices, 5.375% Interest Rate, 50 year Period of Analysis)

Potential induced damages in the Armourdale and CID Units result from the rare flood events and flood stages that occur above the existing top of levee elevations in these units, and would be incurred beginning with about a 300 year, or more rare, event. If a 300 year or greater flood event would occur in the interim time period before completion of any Armourdale and CID Unit raises, the Argentine Unit raise alternatives would increase profiles and flood depths by approximately 6 inches or less in the Armourdale and CID Units. With a 300 year event, structures in the Armourdale and CID Units would already be inundated with maximum flood depths (based on lowest structure elevation) of more than 21 feet and average flood depths (average for all structures) of about 15 feet in the Armourdale Unit and nearly 7 feet in the CID Unit. Induced flooding would add an additional 6 inches or less of flood depth on these structures.

The Argentine raise alternatives, during occurrence of rare flood events, would also induce six inches or less of additional flood depth in low-lying unleveed areas on both sides of the river just upstream of the Argentine and Armourdale Units and in another small unleveed area (approximately 4 residences impacted) near the 7th Street bridge, across from the Armourdale Unit. These areas are unprotected and would already be inundated with high flood depths before any induced flooding resulting from an Argentine Unit raise would begin to occur.

The high water events that cause induced damages upstream and downstream of the Argentine are not characterized as intermittent and frequent and are therefore, not considered a

"taking". However, they are included in the economic analysis of each raise alternative as a direct cost of implementation. No mitigation is proposed for induced damages.

The Argentine no action alternative does not induce any damages elsewhere and has no other direct costs of implementation. Implementation of the Argentine Unit raise alternatives does not impact the Missouri River Units (Fairfax-Jersey Creek, North Kansas City, East Bottoms and Birmingham), and residual damages in those Missouri River Units would remain the same as for the future without project condition in those units.

In regards to environmental justice and the potential for induced damages to potentially impact low income and/or minority residents, the area of potential affect for the Armourdale and CID units consists of the entire protected areas within these units and the unleveed areas previously mentioned. The composition of minorities and low-income residents, and sensitive populations are provided in section 4.15. The damages that could occur to individual residents are somewhat variable and depend in part on the degree of flooding and inundation timeframe.

The area of potential affect for the upstream, unleveed reach is located from approximate Kansas River miles 9.0 to 14.6, within zip code 66111. There are six mobile home parks, two churches, commercial businesses and private residences within the induced damage area of effect as determined by field surveys and available mapping. Near the 7th Street Bridge area, four houses would be subject to induced flooding within zip code 66103. Minority, low-income residents, and sensitive populations may occupy these areas.

All of the alternatives proposed for the Kansas Citys' levee units under the recommended

4.17 Navigation

 plan would benefit navigation. Of the rivers located within the project area, commercial navigation only occurs on the Missouri River. It is likely that navigation would be closed or safety zones established prior to the failure of any part of the Kansas Citys' line of protection. Navigation is generally affected by channel obstructions, drought and other variables. River closure or the recommendation of navigation safety zones depend on river stage (present and forescasted), levee conditions, boats in the reach, and other factors. Navigation would likely be closed or navigation safety zones established prior to the failure of any portion of the line of protection. Construction of the preferred alternatives for the levee units addressed in this study would primarily serve to keep navigation viable following a flood event.

4.18 Recreation

No significant impacts to recreation would be anticipated from the recommended plan formulated for the Kansas Citys' levee units. All of the preferred alternatives would protect river recreation and park facilities from overtopping and/or underseepage failure. The location of most of the proposed reliability improvements are in reaches of the rivers where recreation is generally low. The majority of parks within the units are located landward of the existing levees within the protected areas. Although no direct adverse impacts to recreation would be anticipated as levee improvements would improve the integrity of the line of protection, the generation of noise and dust could impact park use, especially if levee improvements were constructed in the spring to fall seasonal timeframe when rivers and parks are mostly utilized. The flood damage reduction reliability features of the Kansas Citys' levee units primarily protect

an industrialized floodplain. Industrial activities and associated noise including rail, aircraft, and truck traffic are common within the majority of the levee units. In many areas, industrial noise is buffered by riparian vegetation along the foreshore of the rivers located within the project area. Due to the relative proximity of Kaw Point Park to the Fairfax-Jersey Creek sheetpile wall, the preferred alternative for this location could adversely, indirectly impact recreation.

Kaw Point Park and associated walking trails are located approximately 0.1 miles from the proposed construction area. Adjacent businesses will be subject to short-term construction noise. Noise levels would return to their previous level following construction.

Impacts to recreation are variable depending on the seasonal timeframe of construction. Sheetpile installation during the spring and summer months would likely disrupt boating and fishing within the vicinity of construction. Visitors to Kaw Point Park, which includes a series of walking trails, would be disrupted by construction noise. Sheetpile installation during the fall and winter, when the level of outdoor activities decrease, would have less potential of disturbance to park visitors. According to the National Park Service Midwest Regional Office, Kaw Point Park is a Land and Water Conservation Fund project (J. Krejci, National Park Service Outdoor Recreation Planner, personal communication). No direct impacts to the park and associated trails are anticipated as a result of sheetpile wall installation. Short-term, temporary construction-related impacts would include noise and dust generation. It is not anticipated that a conversion of park use will occur as a result of sheetpile installation. Sheetpile installation is estimated to be completed in less than one year. However, the Kansas City District would seek to obtain a waiver from the National Park Service if it is later determined that the construction timeframe would be one year or greater. Upon completion of construction, there would be no further impacts to recreation. A new sheetpile wall would contribute to the protection of the park during high water events.

In accordance with CEQ Memorandum, August 10, 1980, adverse effects to the Kansas River were avoided. Upon completion of construction, the 57-mile reach of the lower Kansas River located between I-635 and the Delaware River listed on the Nationwide Rivers Inventory (NRI) in 1982 would not be anticipated to be removed from the Nationwide Rivers Inventory for potential inclusion into the National Wild and Scenic Rivers System as a result of the recommended plan.

5. Cumulative Impacts

5.1 General

The combined incremental effects of human activity are referred to as cumulative impacts. While these effects may be insignificant on their own, accumulated over time and from various sources they can result in serious degradation of the environment. The analysis must consider past, present and reasonably foreseeable actions in the project area and the consideration of actions outside of the Corps, to include other State and Federal agencies. As required by NEPA, the Corps has prepared the following assessment of cumulative impacts related to the alternatives considered in this DEIS. The potential impacts resulting from preferred and tentative preferred alternatives were discussed in Chapter 4 of this EIS. The analysis indicates that there are no substantial impacts resulting from the proposed reliability improvements that comprise the recommended plan.

The methodology used to determine the potential for significant cumulative impacts included the following:

- 1. <u>Phase I and II Actions:</u> Identify the location and extent of impacts resulting from the proposed actions for the Kansas Citys' flood damage reduction study during both the construction and operational phase. Identify all past, present and potential reasonable future public and private sector projects from existing reports and thru interviews with local planning agencies that may result in cumulative impacts.
- 2. <u>Determine Cumulative Impact Zone</u>: The boundary of the cumulative impact analysis zone varies according to the resource evaluation category considered. The potential cumulative impact zone considered extended along the river basin beyond the project area to determine upstream and downstream impacts. For many of the resource categories considered, the impacts of the recommended plan are not anticipated to extend beyond the footprint of the proposed project. Based on the impacts discussed in Chapter 4 of this DEIS, if impacts extend beyond the project footprint the impacts they are not anticipated to be substantial.
- 3. <u>Determination of Significant Impact:</u> The determination of a significant impact for the cumulative analysis will be the same as for the Chapter 4 Environmental Consequences section. The term significant impact as defined in Paragraph 1508.27 of the Regulations for Implementing the National Environmental Policy Act (NEPA) (40 CFR), requires consideration of both the context and intensity of the impact evaluated.
- 4. Past, Present and Foreseeable Future Actions: Past and present actions are defined as all actions occurring regionally or in the project boundary area including demographic trends, land use changes, Corps programs, other government agency actions and past and current private development in the area of the Kansas Citys' levees flood damage reduction reliability improvement projects. Foreseeable future actions include plans that have been identified and defined with respect to a future timeframe and general location for the proposed development or activity.

5.2 Past and Present Actions

Missouri River

The presettlement Missouri River was a diverse riverine ecosystem that meandered across the floodplain with braided channels, sloughs, chutes, islands, sandbars, backwaters, prairies, riparian woodland and other habitats. Significant modifications to this ecosystem followed European settlement. Snag removal and occasional bank protection was initiated on the Missouri River in the 1800s to aid commercial navigation. Since 1912, seven separate acts of Congress provided for the construction and maintenance of a navigation channel and bank stabilization works. The Missouri River Bank Stabilization and Navigation Project (BSNP) included placing revetments on the riverbanks, closing off sloughs and side channels and constructing pile dikes. Later work included dredging and rock dike construction.

Construction and long-term operation and maintenance of the BSNP created an inland navigation system and provided many benefits such as protecting utilities, transportation networks, bridges, and adjacent landowners and farms. However, the BSNP shortened the river by about 72 miles and decreased the acreages of riverine habitat (aquatic, island, and sandbar) and meander belt habitat (riparian timber, wetlands, sandbars, and other habitat types) (USFWS, 1980). The construction and operation of the BSNP also decreased channel width, shallow water habitats, river surface area, and suspended sediment transport. The Corps estimated that 522,000 acres of aquatic and terrestrial habitat would be lost from the natural channel and meander belt between 1912 and 2003 (Ferrel, 1996). Table 5-1 below provides a breakdown of this estimated acreage. The Water Resources Development Act of 1986 authorized a fish and wildlife mitigation program in Iowa, Nebraska, Kansas, and Missouri designed to restore, develop, and preserve some of the habitat lost due to the BSNP. The mitigation project is ongoing.

Table 5-1. BSNP Estimated Habitat Loss

Habitat Changes in Acres by State					
		1912-2003			
	Natural	Channel	Meander Belt		
<u>State</u>	<u>Aquatic</u>	<u>Terrestrial</u>	<u>Terrestrial</u>	<u>Total</u>	
Missouri	55,800	27,700	221,400	304,900	
Iowa	17,100	18,700	29,600	65,400	
Kansas	9,100	2,000	44,000	5,100	
Nebraska	18,200	19,400	59,000	69,600	
Totals	100,200	67,800	354,000	522,000	

Source: Ferrell, 1996.

The BSNP and levee construction has also altered river hydrology. Stabilization has lowered the bed of the Missouri River. Bed degradation on the Missouri River is generally attributed to river training structures (dikes and revetments), commercial sand mining (dredging),

major floods, and river cut-offs. The degree of bed degradation has not compensated for the reduction in channel width. Channel restriction may have resulted in a smaller capacity for flood discharge. Higher flood stages may occur for an equal discharge as a result of a reduced discharge capacity at flood stages.

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Kansas River

The Kansas River ecosystem was historically similar to that previously described for the Missouri River, though on a smaller scale (USFWS, 1980). Meandering caused erosion and deposition, creating unvegetated sandbars and islands. Compared to the Missouri River, the Kansas was relatively stable within its floodplain boundaries. European settlement also significantly altered the Kansas River ecosystem. Overbank flows and lateral channel migration have decreased since the impoundment of tributary reservoirs (Corps, 1988 and USFWS, 2000-BiOp). Similar to the Missouri, Kansas reservoirs trap sediment and bed degradation has occurred. Kansas River bed degradation is primarily attributed to commercial sand and gravel mining (dredging). Riverbed degradation has been addressed by numerous authors, including Simons et al. (1984), the Kansas Geological Survey (1998), and others. In 1990, the Kansas City District implemented a regulatory program for commercial dredging activities on the Kansas River, which consisted of dredging restrictions to minimize impacts and a monitoring program to assess the impacts of permitted dredging activities on the Kansas River. A restricted floodplain, bank erosion and floodplain encroachment have altered both channel, and off-channel vegetation composition. Although accurate data are not available, the acreage of off-channel wetland habitats have likely declined along the Kansas River (USFWS, 2000).

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Missouri and Kansas Rivers

Flora and fauna have been substantially impacted by channelization of the Missouri River and reservoir construction and operation on the Missouri and Kansas Rivers as acreages of wetlands, grassland, bottomland timber, sandbar, and free-flowing river were flooded or eliminated (USFWS, 2000). Reservoir construction and operation has also decreased sediment transport and turbidity in the river, river meandering, the natural flood pulse, substrate diversity, affected the temperature regime, and impeded fish migration. Flow modifications have also impacted sensitive species, populations, communities, and ecosystems. Nebraska, Iowa, Kansas and Missouri have classified numerous organisms as rare, threatened or endangered as a direct or indirect result of river and floodplain modifications and operation. These include the pallid sturgeon, piping plover, and others. Substantial direct and indirect impacts to both state- and Federal threatened species have occurred from a variety of sources including overharvest, pesticide use, and the construction and operation of channel training structures and reservoirs. In accordance with the USFWS 2003 Amendment to the 2000 Biological Opinion on the Operation of the Missouri Mainstem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project, and Operation of the Kansas River Reservoir System, the Kansas City District and Omaha District are currently working on the restoration of shallow water habitat for the federally endangered pallid sturgeon along the Missouri River. Restoration work conducted by the Corps in 2004-2005 consisted of excavating dike notches and development of pilot channels and chutes.

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No substantial impacts to threatened and endangered species are anticipated from increasing the reliability of the Kansas Citys' existing flood damage reduction system as a result

of the recommended plan. Although the Kansas City reach likely contained numerous species that are presently listed as threatened or endangered, the project area for some time has been heavily industrialized and dominated by urban tolerant, common species. With the exception of the impacts that have occurred from Kansas and Missouri river modifications, a relatively small amount of riparian and wetland acreage would be directly or indirectly impacted by the recommended plan. The habitat impacted by the recommended plan primarily consists of areas planted with grasses (brome, fescue, and rye) that are maintained and inspected for levee integrity. The USFWS does not consider these habitat types or their locations as those that used by the threatened and endangered species reported to occur within or adjacent to the project area, including the 3 relatively small wetlands impacted by the recommended plan. The anticipated impacts to wetland and riparian habitat from the recommended plan are additive to those that have occurred in the past. However, these impacts are relatively minor and are not considered substantial. Riparian impacts if unavoidable will be minor and incidental to the construction activities associated with the project. These impacts would not substantially alter the habitat quality of the existing environment.

In addition to impacting fish and wildlife habitat to protect the economic benefits provided by agriculture and various industries, the construction and operation of manmade river structures, including levees and floodwalls, have a history of altering riverscape aesthetics. Due to the request of local interests, the construction of the existing protective works was initiated along the Kansas River by the City of Kansas City, Missouri and the Kaw Valley Drainage District in the early 1900's. Federal flood protection involvement within the Kansas River levee units was initiated between the 1940's and the early 1950's prior to, and after the 1951 flood. Additional improvements to the Kansas line of protection were completed in the late 1970s.

The height of the existing levees and floodwalls are generally between twelve and fifteen feet. The levee raises and floodwall construction proposed along the Kansas River are considered a minor additive impact compared to the existing protection and a moderate impact compared to the raises proposed for this project. This construction would be additive to the visual quality impact of the existing line of protection. None of the proposed height increases would obstruct the view of the wetlands impacted by the proposed recommended plan. Wetlands impacted by the recommended plan are located landward and downgradient of the existing line of protection. The proposed raise would further obstruct the view of industry from the Kansas River. The view of the farmed wetland within the proposed borrow area would be impacted as it would likely be excavated, or otherwise hydraulically altered by the recommended plan. No increased substantial visual quality impacts are anticipated from the construction of underseepage improvements as these improvements are generally constructed landside and downgradient of the existing levee and are not readily viewed from the Missouri, Kansas, and Blue Rivers.

Reservoir construction on the Missouri and Kansas Rivers and the protection offered by Federal levees on the Missouri River provide numerous recreational opportunities for the public. Boating, fishing, camping, and other activities continually provide millions of dollars in economic benefits. In addition to Federal recreation facilities, many state, county, city, and private recreation areas exist that provide numerous economic and health benefits. Some private and Federally-owned levees provide recreation benefits as they are used for hike and bike trails.

It is unlikely that any of the levee improvements would result in a long-term decrease in the number of visitors to a particular park. Although no direct impacts to recreation and parks are anticipated, minor indirect impacts from the noise or dust generated by construction within the vicinity of parks may temporarily disrupt park visitors. Sheetpile wall installation within the Fairfax-Jersey Creek levee unit could result in a temporary conversion of use of Kaw Point Park depending on the construction timeframe. The viability of the existing parks and recreation areas within the levee units is protected by the existing line of protection and reliability improvements would increase the protection of these resources and the benefits they provide.

Development behind levees has resulted in heavily urbanized and industrialized floodplains. Completion of the BSNP and dam construction along the Missouri and on Kansas River tributaries preceded much of the development on the Missouri and Lower Kansas River floodplains and resulted in extensive agriculture use of the floodplain. Noise and air quality impacts greatly increased as urban and industrial development increased. The recommended plan would cause a temporary noise increase and air quality impact in the project area from construction. The increased emissions from construction are additive to the existing air pollution but would not substantially impact air quality. With the exception of sheetpile driving, construction noise would blend with the existing variety of noise that currently occurs within the project area. This noise increase is additive but would cause a temporary increase that is not anticipated to be significant. In addition to increased noise, the additional traffic from transporting soil from the proposed borrow area would have a temporary additive impact to the existing heavy truck traffic that occurs along the proposed haul route. This temporary increase is anticipated to be adverse but is not anticipated to be significant.

Floodplain development has also resulted in substantial prime farmland impacts. The majority of the floodplain soils mapped within the project area are classified as prime farmland by the NRCS. The majority of the work proposed for the Kansas Citys' levees project would occur from the crown of the existing levee or landside of the existing levee. Prime farmland soils would be removed from a portion of the proposed borrow area and placed on or adjacent to the existing levee within the floodplain on mapped prime farmland soils or other soils. In the absence of the proposed project, these soils would be only locally disturbed in the short-term. Due to the periodic demand for borrow soil it is anticipated that this land would be sought for borrow by some entity in the future. Soil borrowing from foreshore areas within the project area as observed from aerial photography would continue as it is more cost effective to haul borrow required for a local project from a local source. The relocation of prime farmland within the floodplain is additive to the borrow activity that occurred from construction of the existing levees and other governmental and private projects. Although the impacts to prime farmland soils from the recommended plan are adverse, prime farmland soils are relatively abundant within the project area counties and the recommended plan would result in a relocation of additional prime farmland soil within the floodplain.

Over the years, agricultural land has been replaced by urban development, particularly near metropolitan areas such as Kansas City and St. Louis (MRBO 2000). The Federal Emergency Management Agency's (FEMA) National Flood Insurance Program currently regulates development on the floodplain. Although minimizing development within the mapped 100-year flood plain, this program does not prevent development on the natural floodplain outside of the 100-year floodplain boundary. The Flood of 1993 demonstrated that during

extreme events there still remains the potential for out-of-bank flows and associated damages on the Kansas River. After the Flood of 1993, FEMA sponsored buyouts of properties that were highly susceptible to flooding on the Kansas River floodplain. Per FEMA mapping, the areas currently protected by the Kansas Citys Levees are outside of the 100-year floodplain. Development that occurs within the floodplain would not be in violation of Executive Order 11988. These protected areas are heavily urbanized and intense development has been in place for many years. Significant development is not anticipated to be induced by the proposed levee project because very little open space remains and any recent development has primarily consisted of improving old structures, or razing old structures and replacing with new structures. Although no reliability improvements are proposed for the Birmingham levee unit, it is anticipated that this unit will become slowly developed. Within the Kansas City area and other areas of the Midwest, the eventual development of agricultural land is commonplace and would be anticipated to occur without construction of the recommended plan.

Water quality degradation has occurred and will continue to occur from agricultural practices and urban development. The water quality of the Kansas and Missouri River and the majority of their tributaries, including the Blue River, has been significantly degraded by both point- and nonpoint source pollution. The Natural Resources Conservation Service working with farmers in the basin has implemented soil and water conservation practices on much of the remaining agricultural land in the basin. While these practices have minimized the adverse affects from chemical pesticides, herbicides, and fertilizer in agricultural production, they continue to contribute to decreased surface water quality. The development of industry along the floodplain has resulted in soil and groundwater contamination and the runoff from existing agricultural practices contribute a variety of pesticides and herbicides to adjacent waterways. The Clean Water Act, as amended, is the principle law governing pollution control and water quality of the Nation's waterways. Most water quality impairments in the Missouri River basin are indirect impacts as they result form a combination of pollutant sources and hydrologic conditions throughout the watersheds (Corps, 2004). Water quality in the Kansas River is affected primarily by nonpoint sources during storm runoff (USGS, (http://ks.water.usgs.gov/Kansas/pubs/press/KSriver.kdhe.9-05.pr.html).

Due to the excavation and soil placement that will occur to improve the existing levee system, there is a potential for a small amount of soil to inadvertently enter the rivers within the project area and cause a short-term, localized increase in turbidity. However, the recommended plan is not anticipated to significantly degrade waters of the United States, or significantly adversely affect aquatic life. The proposed levee improvements have been evaluated for compliance with section 404 of the Clean Water Act. A draft 404(b)(1) evaluation is included as appendix H of this DEIS.

5.3 Future Foreseeable Actions

Missouri River

 The Missouri River has been subject to factors that may have affected river stages. Natural and man-made dikes that force energies of the river away from the main channel border have caused the main channel to convey more flow during low flows and increasing stages are observed under high flow conditions. Both man-made features and natural processes may affect Missouri River future conditions. The construction of Missouri River Levee System (MRLS) L385 was completed in 2005. This levee extends from River Mile 371.4 to 376.5 on the left bank of the Missouri River. The planning of this levee evaluated the hydrologic and hydraulic effects of the new levee on existing flood protection projects, including the Kansas Citys' local protection.

Natural processes include land accretion and erosion within the floodplain. Land accretion behind dikes placed for navigation channel alignment affect flood flow stage changes along the Missouri River. Flows deposit sediment in the quiescent area downstream of the navigation dike structures. This sediment builds over time and encroaches further into the channel. As time passes, vegetation grows and stabilizes this accreted land from future erosion and allows the cycle to continue further into the channel. This cycle produces the stands of timber behind dikes along the riverward side of some levees. Substantial accretion and tree growth within the project area is located along the left bank of the Missouri River in the reach between the North Kansas City Downtown Airport levee segment downstream to about the I-435 crossing near the downstream end of the East Bottoms levee unit. Land accretion and tree growth, and other variables affect river stages. This cycle may contribute to the upward stage trends of high flows observed for the Missouri River. The existing and future creation of shallow water habitat may negate some of these affects as accreted land erodes and is replaced with shallow slack water areas that benefit fisheries and wildlife. However, the effects of this cycle on river hydraulics have not yet been studied by the Kansas City or Omaha Districts.

Future foreseeable actions within the project area are primarily anticipated to occur within North Kansas City. The proposed Downtown Airport runway extension, if constructed, could require fill in the floodway at river mile 369.2. The responsibility for addressing fill impacts to the flood control works lies with the runway extension proponent. Coordination and assuring compliance is through the non-Federal flood control work's sponsors. This project is currently under review by KCD through the Inspection of Completed Works Program, which provides technical review of proposed work analysis and design. It is currently undetermined if this project will affect water surface elevations. Proposed projects may be approved if there are no adverse impacts to the flood control works.

The North Kansas City Hillside Ditch parallels the northern extent of the North Kansas City Levee Unit (Figure 5-1). The ditch drains west-to-east and is bounded by bluffs to the north and a levee tieback to the south. There are two functions of the Hillside Ditch. The primary function of the ditch and levee tieback is to protect North Kansas from a Missouri River flood. When high water events occur, water backs up into the Hillside Ditch via Rock Creek. The ditch also intercepts stormwater runoff from the adjacent bluff, which is conveyed into Rock Creek, a tributary of the Missouri River, within the confines of a culvert beneath Highway 210. The AE

firm Burns & McDonnell is currently investigating the capacity of the Hillside Ditch and the level of service provided by the levee. A local community housing development is underway in North Kansas City within the vicinity of the Hillside Drainage ditch area. Although it is presently undetermined, overtopping reliability improvements may be recommended.

Repairs to the Broadway Extension in North Kansas City will likely be completed in the next two to three years. Construction may include a landside wall replacement.

The Missouri Department of Transportation (MODOT) has proposed improvements to the interstate system between Missouri 210 and downtown Kansas City, Missouri, including the Paseo Bridge crossing over the Missouri River. A DEIS for the Interstate 29/35 Corridor Improvement Project was issued and public hearings were held May 9 and May 11, 2006. Although a preferred alternative was preliminarily identified by MODOT within the DEIS, the final selection of a preferred alternative will not be made until all agency and public comments, and associated impacts have been considered (MoDOT, 2006). This project is currently being reviewed by KCD in regards to its effects on river hydraulics. Impacts to river hydraulics and navigation are currently unknown.

Project sponsors have requested that the Corps review the possibility of making a permanent tieback improvement at the extreme lower end of the Fairfax-Jersey Creek unit (Figure 5-2). Original project tieback measures have been compromised over the past decades. Tieback improvements may involve a short segment of 3 ft high floodwall or embankment under the Lewis & Clark viaduct area. No analysis has been conducted regarding this project feature. The analyses conducted for this feature and resulting recommendation will be included in the Final Interim Feasibility Report and the Final Environmental Impact Statement.

Kansas River

The proposed preferred and tentative preferred alternatives for the Kansas River levee units discussed in this DEIS are the only known projects in the foreseeable future that would affect water surface elevations. Since the upper reach is currently heavily vegetated with mature tree growth, it is not anticipated that future hydraulic conditions will substantially change from the further maturity of this vegetation. It is also anticipated that since the lower reach has not had significant vegetation growth from 1955 to the present, minimal to no growth would occur in the future. Bed degradation, which is caused in part by river mining operations, is anticipated to continue.

5.4 Other Regional and Site Specific Actions

The Mid America Regional Council (MARC), Bistate interest, and regional economic development agencies will continuing to develop a growth management plan and program focused on a variety of objectives including, but not limited to:

Developing a consistent set of planning and development policies, and zoning and building code regulations to be applied equally to the cities and surrounding areas. This includes coordinating planning activities in a manner designed to reduce potential conflicts between incompatible uses through the use of management tools and zoning programs.

Working with federal, state and local agencies to coordinate expansion and augmentation of public streets, utilities, water and sewerage systems, commercial services, quality of life programs, and job opportunities for residents. The routine, ongoing maintenance of federal, state, county, and local highways, roads, and bridges is a priority requiring extensive agency coordination. Contacts with the State of Missouri Department of Transportation and the State of Kansas Highway Department, county and local officials confirmed that emphasis is being placed on maintenance and repair of existing transportation systems. MARC emphasizes the use of Best Management Practices and other environmental controls during construction activities, which have reduced the potential impact of such activities on surface waters.

One of MARC's highest priorities is the increased construction of greenways and trails for health and economic benefits. This may include the application of funds from the Federal Recreational Trails Program, which provides for trail-related construction and maintenance. Grant recipients are selected based on recommendations from the Missouri Trails Advisory Board (MDNR, 2006).

5.5 Cumulative Impacts Conclusion

Based on the analysis of past and foreseeable activity along the river systems, the changes of the existing line of protection within the Kansas City reach under the recommended plan cause minor changes within existing project boundaries. Those changes involve small raises of existing levees, the structural improvement or replacement of floodwalls and a sheetpile wall, and underseepage control improvements. Reliability improvements would provide an approximate 500-year level of protection without creating substantive changes in river morphology or hydrology, habitat changes along the river, or impacts to terrestrial or aquatic wildlife.

Hydraulic changes along the Kansas and Missouri Rivers analyzed using the HEC-RAS model showed no or minor changes to flood stage height under extreme flooding conditions. The limits of stage height increase were generally within and just upstream of the lower Kansas River units. Stage heights upstream and downstream of Kansas City were not impacted by the recommended plan. Impacts to wetlands would occur and potentially a small number of trees within the construction footprint could be impacted. However, these impacts along with mitigation of these impacts would not result in substantial changes to local or regional habitat or a loss of natural resources to the river and the public using those resources.

Based on the analysis provided in this DEIS, the recommended plan of constructing flood damage reduction reliability improvements within the Kansas City reach of the Missouri and Kansas Rivers will not result in substantial impacts to river reaches upstream or downstream of the project area. As such, cumulative impacts of the recommended plan are not considered significant.

6. List Of Preparers

The following is a table showing the preparers of the DEIS, their area of expertise, and the sections of the DEIS to which they contributed.

NAME	TITLE	AREA OF EXPERTISE
John Atkinson	GIS Specialist, Corps of Engineers, Kansas City District	Geographic Information Systems, Mapping and Graphical Exhibits
Debbie Bishop	Environmental Protection Specialist, USEPA	Environmental Justice
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Kimberly O. Johnson	Environmental Engineer, USEPA	NEPA Compliance, Air Quality, HTRW
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Lamar McKissack	Planner & Project Manager, Corps of Engineers, Kansas City District	Project Planning and Study Manager
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Roger Trundell, Chairman Santee Sioux Tribe Route 2 Niobrara, NE 68760

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Mr. Richard Leonard FEMA - Region VII 2323 Grand Blvd #900 Kansas City, MO 64108 Mr. Bob Frankie FEMA - Region VII 2323 Grand Blvd #900 Kansas City, MO 64108

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Federal Railroad Administration 1120 Vermont Ave., N.W. Washington, D.C. 20590

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Jayhawk Audubon Society P.O. Box 3741 Lawrence, KS 66046

Thomas Hart Benton Group -Sierra Club P.O. Box 32727 Kansas City, MO 64171-5727

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Bayer Chemical Corporation (MoBAY) 8400 Hawthorn Rd. Kansas City, MO 64120

National Starch Corporation 1011 Bedford Avenue North Kansas City, MO 64116

APAC-Kansas Inc 4318 Speaker Road Kansas City, Kansas 66105

Wilcox Truck Line 4318 Speaker Road Kansas City, Kansas 66105

Thompson Bros Inc. 4200 Speaker Road Kansas City, Kansas 66105

Roadway Express 233 42nd St. Kansas City, Kansas 66105

Roadway Express Inc 323 39th St. Kansas City, Kansas 66105

Overnite Transportation Co 3800 Kansas Ave. Kansas City, Kansas 66105

Overnite Transportation Co 500 36th St. Kansas City, Kansas 66105

Overnite Transportation Co 535 36th St. Kansas City, Kansas 66105

Helen Knapp 601 26th St. Kansas City, Kansas 66105

Jud Knapp 609 26th St. Kansas City, Kansas 66105 Gross Auto Salvage Inc 617 26th St. Kansas City, Kansas 66105

Kaw Valley Drg Dist 619 26th St. Kansas City, Kansas 66105

Blance Rangel 621 26th St. Kansas City, Kansas 66105

Marlin S Gross 705 26th St. Kansas City, Kansas 66105

B & H Auto Salvage Inc 761 26th St. Kansas City, Kansas 66105

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United States Postal Service 4900 Speaker Road Kansas City, Kansas 66105

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Automotive Rental, Inc. 200 NW Harlem Road Kansas City, MO 64116

CCH Enterprises, LLC P.O. Box 29048 Kansas City, MO 64152

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The Independence Examiner P.O. Box 459 Independence, MO 64051

The Kansas City Kansan 901 N. 8th St. Kansas City, KS 66101

The Daily Record 405 E. 13th St Kansas City, MO 64106

The Dispatch Tribune 7007 NE Parvin Rd. Kansas City, MO 64117-1532

Dos Mundos Newspaper 902 Southwest Blvd. Kansas City, MO 64108-2341

Kansas City Business Journal 1101 Walnut Kansas City, MO 64106

The Kansas City Call 1715 E. 18th St. Kansas City, MO 64108-1611

Kansas City Hispanic News 615 E. 29th Kansas City, MO 64109-1110

The Record P.O. Box 6197 Kansas City, KS 66106

The Northeast News 5715 St. John Kansas City, MO 64123-1819

Sun News of the Northland 5522 NE Antioch Rd. Kansas City, MO 64119-2301 The Liberty Tribune 104 N. Main Liberty, MO 64068

The Raytown Tribune 10227 E. 61st St. Raytown, MO 64133

The Wednesday 20 E. Gregory Kansas City, MO 64114

The Northland Business Ledger 7007 NE Parvin Rd. Kansas City, MO 64117

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Mid-Continent Public Library – Parkville Branch 8815 NW 45 Highway Parkville, MO 64152-3522

Mid-Continent Public Library – North Oak Branch 8700 N. Oak Kansas City, MO 64155-2437

Kansas City Missouri Public Library - Main 311 E. 12th St. Kansas City, MO 64106

Kansas City Missouri Public Library – Northeast 6000 Wilson Rd. Kansas City, MO 64123

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Mike Farley 175 Quindaro Florissant, MO 63034

Senator Jim Talent U.S. Senate Washington, DC 20510

Wyatt Phillips 15290 Highway 135 Boonville, MO 65233

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Kansas Dept of Wildlife & Parks Attn: Steve Williams 900 SW Jackson-Suite 502 Topeka, KS 66612

Michael Kruger 69 South Logan Street Denver, Co 80209-1808

U.S. Army Engineer District, Tulsa Attn: David Manning, CESWT-PER-R 1645 S 101st East Ave Tulsa, OK 74128

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F.W. Dodge Company Attn: Lea Anne Hutton 5700 Broadmoor, Suite 100 Mission, KS 66202 Kansas State Historical Society Attn: Dick Pankratz 6425 S.W. 6th Avenue Topeka, KS 66615-1099

Natural Resources Conservation Service 760 S. Broadway Salina, KS 67401-4642

U.S. Army Engineer District, Tulsa Attn: Ron Bell, Ch Reservoir Control 1645 South 101st Eave Avenue Tulsa, OK 74128

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KS State University, Div of Biology Spencer Tomb Ackert Hall Manhattan, KS 66502

State Conservation Commission Attn: Greg Foley 109 SW 9th Street, #500 Topeka, KS 66612-1299

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201
Kansas City, MO 64101

Hispanic Economic
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UMKC Cheryl Hooper 5110 Rockhill Rd Kansas City, MO 64110-2823 Future is Now Rae Peterson 123 W Armour Blvd. Kansas City, MO 64111-2005

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Heart of America Indian Center Justin Orr 600 W. 39th St. Kansas City, MO 64111-2910

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Dorothy Oliver 5129 N Bellaire Ave Kansas City, MO 64119-3828

Kansas City Library North East Branch Claudia Visnich 6000 Wilson Rd Kansas City, MO 64123-1942

Rose Howard P.O. Box 270625 Kansas City, MO 64127-0625

Kansas City Harmony 2700 East 18th Street Kansas City, MO 64127-2602

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Department of Energy Ms. David Hampton PO Box 401202 Kansas City, MO 64141-0202

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Share Inc. Al Hannah 10015 NW Ambassador Dr. Suite 200 Kansas City, MO 64153-1437

FOUCUS-KCMO Sharon Cheers, Esq. P.O. Box 32076 Kansas City, MO 64171-0574

Fellowship of Reconciliation 5123 Truman Rd Kansas City, MO

W. MO. Coal. To Abolish Death Penalty P.O. Box 45302 Kansas City, MO

Blue Hills Neighborhood Association Pat Keeling 5309 Woodland Kansas City, MO

Availability of the EIS

LIBRARIES

The following libraries have the draft and final Feasibility Report Environmental Impact Statement available for public review:

Kansas City Missouri Public Library – Main 311 E. 12th St. Kansas City, MO 64106 816-701-3400

Kansas City Missouri Public Library – West 525 Southwest Blvd. Kansas City, MO 816-701-3655

Kansas City Missouri Public Library – Westport 118 Westport Road Kansas City, MO 816-701-3635

Kansas City Missouri Public Library – North-East 6000 Wilson Road Kansas City, MO 816-701-3585

Kansas City Missouri Public Library – Sugar Creek 102 S. Sterling 816-701-3645

Mid Continent Public Library – North Oak Branch

Mid Continent Public Library – Claycomo Branch 309 NE 69 Highway 64119 816-455-5030

Mid Continent Public Library – Antioch Branch 6060 N. Chestnut 64119 816-454-1306 Mid Continent Public Library – Riverside Branch 2700 NW Vivion Road 8167416288

Mid Continent Public Library – Parkville Branch 8815 NW 45 Highway Parkville, MO 8167414721

CORPS OF ENGINEERS OFFICES

In addition, the draft Evaluation Report/ Environmental Impact Statement will be available for public review during normal business hours at the following Corps Office:

Room 843 U.S. Army Corps of Engineers – Kansas City District Richard Bolling Federal Building 601 E. 12th Street Kansas City, MO 64106 (816) 389-3134

* Visitors to the Federal Building must present current photo identification and pass through a security check before entering the building.

KANSAS CITYS LEVEES FLOOD DAMAGE REDUCTION PROJECT WEBSITE

The draft Evaluation Report/Environmental Impact Statement will be available for public review on the following website:

http:/www.nwk.usace.army.mil/ projects/7levees

This site also includes additional information about the Kansas Citys Levees Flood Damage Reduction Study.

8. Glossary

Base Flood Elevation (BFE) - the height of the base flood, usually in feet, in relation to the National Geodetic Vertical Datum of 1929, the North American Vertical Datum of 1988, or other datum referenced in the Flood Insurance Study report, or average depth of the base flood, usually in feet, above the ground surface.

Emergency Action Plan - a predetermined plan of action to be taken to reduce the potential for property damage and loss of life in an area affected by a dam break.

et seq (et sequens) - and the following one or ones.

Failure - the uncontrolled release of water from a dam.

Floodplain - an area adjoining a body of water or natural stream that has been or may be covered by flood water.

Flood routing - the determination of the attenuating effect of storage on a flood passing through a valley, channel, or reservoir.

Foundation of levee - the natural material on which the dam structure is placed.

Freeboard - the vertical distance between a stated water level and the top of the levee/floodwall.

Grout cutoff - a barrier produced by injecting grout into a vertical zone, usually narrow horizontally, in the foundation to reduce seepage under a dam.

Hydrograph - a graphic representation of discharge, stage, or other hydraulic property with respect to time for a particular point on a stream.

Peak flow - the maximum instantaneous discharge that occurs during a flood. It is coincident with the peak of a flood hydrograph.

Piping - the movement of fine soil particles caused by excessive foundation water pressure generated from high river stages. The water seepage associated with piping can lead to the progressive development of soil erosion.

PMF (Probable Maximum Flood) - a flood that would result from the most severe combination of critical meteorologic and hydrologic conditions possible in the region.

Pressure relief well and collector system - the pressure relief well is a vertical well or borehole, usually downstream of impervious cores and/or cutoffs, designed to collect and direct seepage through or under a levee to reduce uplift pressure under or within a levee. The well is designed to prevent piping of the foundation soil. A line of such wells forms a drainage curtain that generally discharges the collected water into a collector ditch.

47 Reach Index Point – A river mile location in a reach that is used to aggregate the stage damage 48 relationships for the different categories of investment within a reach at a common location. 49 50 Riprap - a layer of large uncoursed stones, broken rock, or precast blocks placed in random fashion on the upstream slope of an embankment dam as a protection against wave and ice 51 52 action. 53 54 Rock Toe – An area of a levee near the bottom of the slope above the existing ground surface 55 that needs to have existing soils, such as clays, sands, and silts, removed and replaced with rock 56 to provide stability. 57 58 Seepage - the interstitial movement of water that may take place through a dam, its foundation, 59 or its abutments. 60 Tieback - A landward extension of the main stem levee that protects interior areas from 61 62 backwater and/or tributary headwater flooding. 63

Underseepage - the interstitial movement of water through a foundation.

64

65 9. Acronyms

- 67 AIRS Aerometric Information Retrieval System
- 68 AOC Areas of Concern
- 69 ASLA American Society of Landscape Architects
- 70 BMP Best Management Practices
- 71 BPU Board of Public Utilities
- 72 DCAR Draft Coordination Act Report
- 73 cfs cubic feet per second
- 74 COE Corps of Engineers
- 75 CRPM Cultural Resource Project Manager
- 76 CWA Clean Water Act
- 77 DEIS Draft Environmental Impact Statement
- 78 DFR Draft Feasibility Report
- 79 EIS Environmental Impact Statement
- 80 EPA –Environmental Protection Agency
- 81 EvR Evaluation Report
- 82 ER Engineering Regulation
- 83 ESA Endangered Species Act
- 84 FCAR Final Coordination Act Report
- 85 FEIS Final Environmental Impact Statement
- 86 FFR Final Feasibility Report
- 87 HTRW Hazardous, Toxic, and Radioactive Waste
- 88 KCD Kansas City District (Corps)
- 89 KDA Kansas Department of Agriculture
- 90 KDHE Kansas Department of Health and Environment
- 91 KDWP Kansas Department of Wildlife and Parks
- 92 KGS Kansas Geological Survey
- 93 KSR Kansas River
- 94 KWO Kansas Water Office
- 95 LUST Leaking Underground Storage Tank
- 96 MoDOT Missouri Department of Transportation
- 97 NAAQS-National Ambient Air Quality Standards
- 98 NEPA National Environmental Policy Act
- 99 NHPA National Historic Preservation Act
- 100 NOA Notice of Availability
- 101 NOI Notice of Intent
- 102 NOx Nitrogen Oxides
- 103 NPDES National Pollution Discharge Elimination System
- 104 NRCS Natural Resources Conservation Service
- 105 NWI National Wetlands Inventory
- 106 OHWM Ordinary High Water Mark
- 107 PAL Planning Aid Letter
- 108 PAR Population at Risk
- 109 PMF Probable Maximum Flood
- 110 RCRA Resource Conservation and Recovery Act

- 111 ROD Record of Decision
- 112 SHPO State Historic Preservation Office
- 113 SIP– State Implementation Plan
- 114 SVOC Semi-Volatile Organic Compounds
- 115 TRIS Toxic Release Inventory System
- 116 USACE United States Army Corps of Engineers
- 117 USDA United States Department of Agriculture
- 118 USEPA United States Environmental Protection Agency
- 119 USFWS United States Fish and Wildlife Service
- 120 USGS United States Geological Survey
- 121 UST Underground Storage Tank
- 122 VOCs Volatile Organic Compounds

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U.S. Army Corps of Engineers, Kansas City District

Appendices

Appendix A

Kansas Citys Levees Feasibility Study Website

U.S. Army Corps of Engineers, Kansas City District

Appendix B

SCOPING COMMENTS

Appendix C

Agency Correspondence

U.S. Fish & Wildlife Service Draft Coordination Act Report

Appendix D

Missouri Department of Conservation Natural Heritage Database Report for Clay and Jackson Counties, Missouri

Kansas Department of Wildlife and Parks State-Listed Threatened and Endangered Species in Wyandotte County, Kansas

Appendix E

Common Mammals, Birds, Amphibians, Reptiles and Fish of the Project Area

Common Mammals, Birds, Amphibians, Reptiles and Fish of the Project Area

Common mammals that may be found in the study area include:

white-tailed deer (*Odocoileus virginianus*) coyote (Canis latrans) opossum (Didelphis marsupialis) raccoon (Procyon lotor) cottontail rabbit (Sylvilagus floridanus) muskrat (*Ondatra zibethica*) beaver (Castor canadense) badger (Taxidea taxus) striped skunk (Mephitis mephitus) fox squirrel (Sciurus niger) plains pocket gopher (Geomys bursarius) little brown bat (*Myotis lucifugus*) least shrew (Cryptotis parva) hoary bat (Lasiurus cinereus) eastern wood rat (Neotoma floridana) eastern mole (Scalopus aquaticus) big brown bat (Eptesicus fuscus) meadow jumping mouse (Zapus hudsonius) woodland white-footed mouse (Peromyscus leucopus) plains harvest mouse (*Reithrodontomys montanus*) western harvest mouse (Reithrodontomys megalotis) prairie white-footed mouse (*Peromyscus maniculatus*) thirteen-lined ground squirrel (Spermophilus tridecemlineatus)

Common resident or migrant birds that may be found in the study area include:

great blue heron (Ardea heordias) belted kingfisher (*Ceryle alcyon*) green heron (Butorides virescens) whip-poor-will (Caprimulgus vociferus) western kingbird (Tyrannus verticalis) blue-winged teal (Anas discors) wood duck (Aix sponsa) horned lark (Cremophilia alpestris) mallard (*Anas platyrhynchos*) blue jay (*Cyanocitta cristata*) red-tailed hawk (Buteo jamaicensis) purple martin (Progne subis) rock dove (Columba livia) black-eyed chickadee (*Parus atricapillus*) tufted titmouse (Parus bicolor) barred owl (Strix varia) starling (*Sturnus vulgaris*) common crow (*Corvus brachyrhynchos*) American kestrel (Falco sparverius) warbling vireo (Vireo gilvus) turkey vulture (Cathartes aura) yellow-breasted chat (Decteria virens) house sparrow (*Passer domesticus*) bobwhite quail (Colinus virginianus) robin (*Turdus migratorius*) morning dove (Zenaida macroura) western meadowlark (Sturnella neglecta) field sparrow (Spizella pusilla) red-winged blackbird (Agelaius phoeniceus) American coot (Fulica americana) common grackle (Quiscalus quiscula) killdeer (Charadrius vociferus) Harris' sparrow (Zonotrichia querula) spotted sandpiper (Actitis macularia) tree sparrow (Spizella arborea) great horned owl (*Bubo virginianus*) chipping sparrow (Spizella passerina)

Appendix E – continued (Birds)

screech owl (*Otus asie*)
common night hawk (*Chordeiles minor*)
red-bellied woodpecker (*Centurus carolinus*)
red-headed woodpecker (*Melanerpes erythrocephalus*)
house wren (*Troglodytes aedon*)
eastern wild turkey (*Meleagris gallopovo*)
brown thrasher (*Toxostoma rufum*)

Common reptiles that may be found in the study area include: snapping turtle (*Chelydra serpentine*) ornate box turtle (*Terrapene ornata*) painted turtle (*Chrysemys picta*) smooth soft-shelled turtle (Apalone mutica) spiny soft-shelled turtle (Apalone spinifera) common five lined skink (Eumeces fasciatus) ground skink (Scincella lateralis) black rat snake (Elaphe obsoleta) western slender glass lizard (Ophisaurus attenuatus) prairie ringnecked snake (Diadophis punctatus) Eastern hog-nosed snake (*Heterodon platyrhinos*) Eastern yellow-bellied racer (Coluber constrictor) bullsnake (Pituophis melanoleucus) prairie king snake (Diadophis punctatus arnyi) diamond backed water snake (Nerodia rhombifer) red-sided garter snake (*Thamnophis sirtalis*) copperhead (Agkistrodon contortrix)

Common amphibians that may be found in the study area include:

tiger salamander (*Ambystoma tigrinum*)
bullfrog (*Rana catesbeiana*)
leopard frog (*Rana pipiens*)
Blanchard's cricket frog (*Acris crepitans*)
plains spadefoot toad (*Scapahiopus bombifrons*)
western chorus frog (*Pseudacris triseriata*)
Woodhouse's toad (*Bufo woodhousei*)
plains leopard frog (*Rana blairi*)

Appendix E – continued

Principal fish species of the Lower Kansas and Missouri Rivers at Kansas City:

channel catfish (Ictalurus punctatus)* gizzard shad (Dorsoma cepadianum)* shortnose gar (Lepisosteus platostomus)* carp (Cyprinus carpio)* sand shiner (*Notropis ludibundus*) freshwater drum (Aplodinotus grunniens) black bullhead (Ameiurus melas) bigmouth buffalo (*Ictiobus cyprinellus*) green sunfish (Lepomis cyanellus) shovelnose sturgeon (Scaphirhynchus platorhynchus) shorthead redhorse (*Moxostoma macrolepidotum*) blue catfish (Ictalurus furcatus) flathead catfish (Pylodictis olivaris) longnose gar (Aplodinotus grunniens) bluegill (Lepomis macrochirus) goldeye (*Hiodon alosoides*) fathead minnow (Pimephales promelas) white crappie (*Pomoxis annularis*) quillback (Carpiodes cyprinus) river carpsucker (Carpiodes carpio)* walleye (Stizostedion vitreum) smallmouth buffalo (Ictiobus bubalus)*

^{*}Dominant species

Appendix F

Common Trees, Shrubs and Grasses within the Study Area

Trees, Shrubs and Grasses Within the Study Area

Predominant tree species found on the project lands include:

honey locust (Gliditsia triacanthos) sycamore (Platanus occidentalis) black walnut (Juglans nigra) green ash (Fraxinus pennsylvanica) chinkapin oak (Quercus muehlenbergii) eastern cottonwood (Populus deltoides) hackberry (Celtis occidentalis) eastern red cedar (Juniperus virginiana)

box elder (Acer negundo)
osage-orange (Maclura pomifera)
slippery elm (Ulmus rubra)
red mulberry (Morus rubra)
black willow (Salix nigra)
white mulberry (Morus alba)
shingle oak (Quercus imbricaria)
silver maple (Acer saccharinum)

Deciduous shrubs on the project lands include:

rough leaf dogwood (*Cornus drummondii*) buckbrush (*Symphoricarpos orbiculatus*) elderberry (*Sambucus canadensis*) fragrant sumac (*Rhus aromatica*) Japanese honeysuckle (*Lonicera japonica*)

smooth sumac (*Rhus glabra*) gooseberry (*Ribes missouriense*) poison ivy (*Toxicodendron radicans*) prairie rose (*Rosa arkansana*)

Grass cover on the project lands include:

Kentucky bluegrass (*Poa pratensis*) Virginia wild rye (*Elymus canadensis*) switchgrass (*Panicum virgatum*) K-31 Fescue (*Festuca elatior*) domestic ryegrass (*Elymus multiflorum*) foxtail grass (*Setaria* spp.)
Johnson grass (*Sorghum halepense*)
domestic ryegrass (*Lolium perenna*)
smooth brome (*Bromus inermis*)
cheatgrass (*Bromus tectorum*)

U.S. Army Corps of Engineers, Kansas City District

Appendix G

Cultural Resource Coordination

Appendix H

Section 404 of the Clean Water Act Compliance Review Documents (Public Notice/Draft 404(b)(1) Evaluation)

U.S. Army Corps of Engineers, Kansas City District

Figures